PROCEEDINGS

OF

THE CHEMICAL SOCIETY.

Vol. XXI. Nos. 288—302.
JANUARY—DECEMBER, 1905.

LONDON:
GURNEY & JACKSON, 10, PATERNOSTER ROW.
1906.

RICHARD CLAY AND SONS, LIMITED,
BREAD STREET HILL, E.C., AND
BUNGAY, SUFFOLK.

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LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1905.

£10 to E. F. Armstrong, for the investigation of the synthesis of maltose, *iso*maltose, lactose, and kindred sugars.

£5 to W. C. Ball, for the investigation into the preparation of complex metallic salts and the conditions of their decomposition by heat.

£15 to E. C. C. Baly, for the investigation of the ultra-violet absorption spectra of organic compounds.

£5 to J. B. Cohen, for the continuation of his investigation on the chlorination and bromination of the aromatic hydrocarbons.

£5 to A. Findlay, for the investigation of the saponification velocities and freezing-point curves.

£10 to F. E. Francis, for the investigation of the action of nitrogen sulphide on organic and inorganic substances.

£3 to J. A. N. Friend, for the investigation of the decomposition of hydrogen peroxide by colloidal platinum.

£5 to J. A. Gardner, for the investigation of hydroxy-compounds obtained from camphopyric acid.

£10 to A. G. Green, for the investigation of the constitution of synthetic dye-stuffs.

£3 to P. Haas, for the investigation of the nitrogen derivatives of dimethyldihydroresorcin.

£5 to J. Hawthorne, for the investigation of the constitution of acidyl thiocyanates.

£10 to F. W. Kay, for the investigation of tetrahydro-*p*-toluic acid.

£10 to T. M. Lowry, for the continuation of his investigations of dynamic isomerism.

£10 to A. McKenzie, for the continuation of his investigations in asymmetric synthesis.

£5 to T. S. Moore, for the investigation of tautomerism.

£10 to R. S. Morrell and E. K. Hanson, for the continuation of the investigations of β-crotonic acid.

£5 to R. H. Pickard, for the investigation of a new method of measuring hydroxyl ions.

£10 to R. H. Pickard, for the continuation of his investigations on optically active carbimides.

£10 to R. Robinson, for the investigation of ethyl piperonylacetate.

£10 to S. Ruhemann, for the investigation of the action of acid chlorides of acetylenic acid on ketonic compounds.

£5 to S. Ruhemann, for the continuation of his investigation on tetrazoline derivatives.

£5 to Miss A. E. Smith, for the study of the transformations and decompositions of *s*-tribromonitroaminobenzene.

£5 to A. W. Stewart, for the investigation of "Steric Hindrance" applied to bisulphite derivatives of ketones.

£20 to J. J. Sudborough, for the continuation of his investigation on "Steric Hindrance" and polynitro-compounds.

£10 to G. Tattersall, for the investigation of the synthesis of carvestrene.

£15 to J. F. Thorpe for the investigation of the preparation of substituted aconitic acids by condensation of ethyl cyanoacetate with ethyl oxalacetate.

£20 to A. E. H. Tutton, for the investigation into the relations between crystallographic form and chemical composition.

LIST OF FELLOWS ELECTED DURING 1905.

Name.	Proposed.	Elected.
Adam, Adam Lawson Kelly	November 2nd, 1905.	December 7th.
Ahlum, C. Chester	,, ,, ,,	,, ,,
Alcock, James Edward	,, ,, ,,	,, ,,
Allison, James Albert	,, ,, ,,	,, ,,
Amos, Arthur	February 15th, 1905.	May 4th.
Andrews, Albert Edward	April 6th, 1905	,, ,,
Angel, Andrea	December 1st, 1904.	February 15th.
Anthony, Charles	November 16th, 1905.	December 7th.
Arnaud, Francis William Fredk	November 16th, 1904.	February 15th.
Ashwell, James Henry	January 18th, 1905.	,, ,,
Barbrook, George Henry	November 2nd, 1905.	December 7th.
Barnes, James Hector	December 14th, 1904.	February 15th.
Barrowcliff, Marmaduke	November 2nd, 1905.	December 7th.
Baxter, John George	March 2nd, 1905.	May 4th.
Bealey, Edward Williams	May 17th, 1905	June 14th.
Bees, William James	,, ,, ,,	,, ,,
Belton, Francis George	April 6th, 1905	May 4th.
Bennett, Joseph	April 19th, 1905.	June 14th.
Bousfield, William Robert	May 17th, 1905	,, ,,
Brettell-Vaughan, Edward Shipley Hewett Edwards	April 6th, 1905	May 4th.
Briggs, Samuel Henry Clifford	January 18th, 1905.	February 15th.
Brown, John Coggin	November 2nd, 1905.	December 7th.
Burt, Bryce Chudleigh	June 1st, 1905	,, ,,
Campbell, Eric William	May 4th, 1905	June 14th.
Campbell, James H.	December 1st, 1904.	February 15th.
Chatterji, Hem Chandra	December 14th, 1904.	,, ,,
Clark, Friend E.	January 18th, 1905.	,, ,,
Clark, Thomas Walter Firth	April 6th, 1905	May 4th.
Clarkson, George Douglas	November 16th, 1904.	February 15th.
Coates, Joseph Edward	November 2nd, 1905.	December 7th.
Colles, William Morris	February 15th, 1905.	May 4th.
Collitt, Bernard	December 1st, 1904.	February 15th.
Coupe, Miles	February 15th, 1905.	May 4th.
Cowie, William Beaverly	May 17th, 1905	June 14th.
Cowman, Douglas Henry Bellars	November 2nd, 1905.	December 7th.
Dallman, Arthur Augustine	,, ,, ,,	,, ,,
Davey, Joseph Morgan	June 1st, 1905	,, ,,
Davies, John Llewelyn	November 2nd, 1905.	,, ,,
Day, William Walpole	May 17th, 1905	June 14th.
De Luty, Ralph Emerson	April 19th, 1905	,, ,,
Dodds, Roger	March 2nd, 1905	May 4th.
Donald, Robert	April 19th, 1905	June 14th.
Doull, John	November 2nd, 1905.	December 7th.

Name.	Proposed.	Elected.
Dunlop, Harry	June 14th, 1905	December 7th.
Dunstan, Sydney	March 2nd, 1905	May 4th.
Eade, Samuel George	November 16th, 1904.	February 15th.
Evans, Bernard Scott	February 2nd, 1905	May 4th.
Ferrier, John Greig	,, ,, ,,	,, ,,
Findon, Frank Standish	March 15th, 1905	,, ,,
Finnemore, Horace	April 6th, 1905	,, ,,
Forster, Ernest Lyle Carman	April 19th, 1905	June 14th.
Gall, John Beaconsfield	November 2nd, 1905.	December 7th.
Gardner, Charles Richard	January 18th, 1905	February 15th.
Gillies, Albert	March 2nd, 1905	May 4th.
Glass, Archibald Melville	February 2nd, 1905	,, ,,
Goodier, Herbert	December 1st, 1904	February 15th.
Gorman, Henry Isaac	March 2nd, 1905	May 4th.
Green, Ernest	,, ,, ,,	,, ,,
Griffiths, John	April 6th, 1905	,, ,,
Groves, Samuel Ernest	February 2nd, 1905	,, ,,
Haig, Sidney Montague	November 2nd, 1905.	December 7th.
Hart, Alfred	,, ,, ,,	,, ,,
Hawthorne, John	March 2nd, 1905	May 4th.
Hayman, Jack Vernon Johnson	November 2nd, 1905.	December 7th.
Healy, Frederick William	January 18th, 1905	February 15th.
Henderson, James Alexander Russell	,, ,, ,,	,, ,,
Hennings, Carl Richard	November 16th, 1904.	,, ,,
Henstock, Herbert	May 17th, 1905	June 14th.
Hetherington, Arthur Lonsdale	March 2nd, 1905	May 4th.
Higgins, John Michael	November 2nd, 1905.	December 7th.
Hill, William Basil	,, ,, ,,	,, ,,
Hobsbaum, Isaac Berkwood	,, ,, ,,	,, ,,
Hollins, Cecil	,, ,, ,,	,, ,,
Howgate, James Henry	April 6th, 1905.	May 4th.
Jack, Maurice Brooks	November 2nd, 1905.	December 7th.
Jarrard, William John	May 17th, 1905	June 14th.
Jones, Bernard Mount	December 14th, 1904.	February 15th.
Jones, Edward Towyn	November 2nd, 1905.	December 7th.
Jones, Percy Walter	January 18th, 1905	February 15th.
Jones, Tudor Foulkes	November 16th, 1904.	,, ,,
Kay, Sydney, A.	March 2nd, 1905	May 4th.
Killby, Leonard Gibbs	,, ,, ,,	,, ,,
Law, Herbert Drake	June 1st, 1905.	December 7th.
Leech, Herbert Louis	December 14th, 1904.	February 15th.
Leek, William Henry	April 6th, 1905	May 4th.
Lewis, Ernest Isaac	March 2nd, 1905	,, ,,
Lister, Joseph	January 18th, 1905	February 15th.
Lloyd, George Moss	December 1st, 1904	,, ,,
Lucas, Edward William	January 18th, 1905	,, ,,
Luck, Alfred Courtenay	December 14th, 1904.	,, ,,
Lyon, Rudolph	November 2nd, 1905.	December 7th.

Name.	Proposed.	Elected.
McCleary, William	November 2nd, 1905	December 7th.
MacKechnie, Robert Drysdale	,, ,, ,,	,, ,,
Maguire, Peter	February 2nd, 1905	May 4th.
Marle, Ernest Robert	,, ,, ,,	,, ,,
Martin, Francis Grimshaw	April 6th, 1905	,, ,,
Martin, Harry	November 2nd, 1905.	December 7th.
Mason, Arthur Walter	May 17th, 1905	June 14th.
Maughan, Reginald Bruce	March 15th, 1905	May 4th.
Meldrum, Andrew Norman	December 14th, 1904.	February 15th.
Micklewright, Harry George Fletcher	November 2nd, 1905.	December 7th.
Millen, John Dunlop	November 16th, 1905.	,, ,,
Mills, William Sloan	November 16th, 1904.	February 15th.
Modi, Edalji Manekji	November 2nd, 1905.	December 7th.
Moore, Charles Watson	December 14th, 1904.	February 15th.
Morris, Eric Haydn	June 14th, 1905	December 7th.
Morris, Edwin	March 15th, 1905	May 4th.
Mortimer, Alfred	April 6th, 1905	,, ,,
Motion, John	November 2nd, 1905.	December 7th.
Neville, Henry Allen Dugdale	,, ,, ,,	,, ,,
O'Farrelly, Alfons	March 2nd, 1905	May 4th.
Penn, Francis Richard	November 2nd, 1905.	December 7th.
Pennycuick, Thomas	December 1st, 1904.	February 15th.
Perkins, Hugh Donald	November 2nd, 1905.	December 7th.
Perrott, Bert	December 1st, 1904.	February 15th.
Phipson, Percy Barker	November 2nd, 1905.	December 7th.
Pooler, Frederick John	,, ,, ,,	,, ,,
Pymán, Frank Lee	January 18th, 1905	February 15th.
Quant, Ernest	December 14th, 1904.	,, ,,
Ratcliffe, William Henry	December 1st, 1904.	,, ,,
Richards, Frederick George	,, ,, ,,	,, ,,
Rigby, Thomas	June 1st, 1905	December 7th.
Rogers, Harold Rudolph	December 1st, 1904.	February 15th.
Ross, Frederick Wilson Montrose	May 17th, 1905	June 14th.
Rowland, James Frederick Fothergill	November 2nd, 1905.	December 7th.
Rowley, Henry	November 16th, 1905	,, ,,
Royle, Harold Marmion	November 2nd, 1905.	,, ,,
Ruston, Arthur Gough	June 1st, 1905	,, ,,
Sarginson, William	March 2nd, 1905	May 4th.
Schnurmann, Harry Nestor	November 2nd, 1905.	December 7th.
Scholefield, Fred	January 18th, 1905	February 15th.
Scott, John Irwin	,, ,, ,,	,, ,,
Schröder, Harold	November 16th, 1904.	,, ,,
Seaton, William Dunham	January 18th, 1905	,, ,,
Setterington, Douglas Temple	November 2nd, 1905.	December 7th.
Shedden, Frank	March 15th, 1905	May 4th.
Shepherd, Charles Stuart	February 2nd, 1905	,, ,,
Simmons, William Herbert	January 18th, 1905	February 15th.
Speight, William Ewart	February 2nd, 1905	May 4th.
Spencer, Arthur Gordon	March 15th, 1905	,, ,,
Steger, James	May 17th, 1905	June 14th.
Stennitt, Sydney Dockeray	April 6th, 1905	May 4th.

Name.	Proposed.	Elected.
Stevens, Edmund Henry	April 6th, 1905	May 4th.
Stevens, Harold Blythen	,, ,, ,,	,, ,,
Swann, Robert Reed	March 2nd, 1905	,, ,,
Taylor, John William	February 15th, 1905	,, ,,
Thomas, George Devenish	March 15th, 1905	,, ,,
Tillot, John Booty	November 2nd, 1905.	December 7th.
Titherley, Arthur Walsh	February 2nd, 1905	May 4th.
Troye, Gustav Arthur	December 14th, 1904.	February 15th.
Tuck, William Bradshaw	May 17th, 1905	June 14th.
Tutin, Frank	November 2nd, 1905.	December 7th.
Wall, Francis Henry	April 6th, 1905	May 4th.
Walpole, George Stanley	November 2nd, 1905.	December 7th.
Want, William Phillip	December 14th, 1904	February 15th.
Weiskopf, Eric H.	January 18th, 1905	,, ,,
Wheeler, Ernest	November 16th, 1904.	,, ,,
White, John Ledger	November 2nd, 1905.	December 7th.
White, John William	May 17th, 1905	June 14th.
Wigginton, John Henry Becker	November 16th, 1904	February 15th.
Wilkinson, John Wells	December 14th, 1904.	,, ,,
Williams, Alan Herbert	,, ,, ,,	,, ,,
Williams, Gerard William	November 2nd, 1905.	December 7th.
Wren, William James	May 17th, 1905	June 14th.

FELLOWS DECEASED, 1905.

Name.	Elected.	Died.
Ackroyd, William	June 17th, 1897	May 9th, 1905.
Blades, Charles Mountain	March 5th, 1885	January 25th, 1905.
Braga, John Francis	March 17th, 1881	January 7th, 1905.
Buckton, George Bowdler	March 1st, 1852	September 25th, 1905.
Bullock, John Lloyd	December 20th, 1842	June 3rd, 1905.
Burnard, Charles Frederick	March 19th, 1849	November 10th, 1905.
Calvert, Jonathan Hindle	December 21st, 1871	June 16th, 1905.
Carpenter, Henry Sanders	May 6th, 1875	September 23rd, 1904.
*Cleve, Per Theodor	February 1st, 1883	June 18th, 1905.
Duncan, James	December 17th, 1863	August 12th, 1905.
Elworthy, Herbert Samuel	March 4th, 1886	November 8th, 1905.
Epps, James	December 3rd, 1885	February 20th, 1905.
Graham, Edward	December 5th, 1895	August 20th, 1905.
Greenwood, William Henry	May 15th, 1873	October 31st, 1905.
Harrold, Frederick William	February 19th, 1891	November 26th, 1905.
Mercer, Francis Montier	December 18th, 1884	January 7th, 1905.
Prasad, Mata	December 3rd, 1903	December 15th, 1904.
Prescott, Albert Benjamin	March 2nd, 1876	February 25th, 1905.
Rickard, William Thompson	February 3rd, 1845	March 28th, 1905.
Roose, Robson	April 15th, 1886	February 12th, 1905.
Shapley, Frederick	December 7th, 1893	August 28th, 1903.
Sutton, Charles William	February 21st, 1884	May 14th, 1904.
Tichborne, Charles Richard Clarke	February 19th, 1863	May 1st, 1905.
White, Leedham	March 20th, 1862	January 26th, 1905.
Will, William Watson	December 17th, 1885	December 12th, 1905.
Yates, Robert	June 4th, 1874	April 18th, 1905.

* Honorary and Foreign Member.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY DURING 1905.

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January 18th.		
1. Nitrogen halogen derivatives of the sulphonamides. By Frederick Daniel Chattaway	7	145
2. Electrolytic oxidation of the aliphatic aldehydes. By Herbert Drake Law	7	198
3. The diazo-derivatives of the benzenesulphonylphenylene-diamines. By Gilbert Thomas Morgan and Frances Mary Gore Micklethwait	8	73
4. The molecular condition in solution of ferrous potassium oxalate. By Samuel Edward Sheppard and Charles Edward Kenneth Mees	10	189
5. A further analogy between the asymmetric nitrogen and carbon atoms. By Humphrey Owen Jones	10	135
6. The formation of magnesia from magnesium carbonate by heat and the effect of temperature on the properties of the product. By William Carrick Anderson	11	257
7. Transformations of derivatives of *s*-tribromodiazobenzene. By Kennedy Joseph Previté Orton	12	99
8. The addition of sodium hydrogen sulphite to ketonic compounds. By Alfred Walter Stewart	13	185
9. The reduction products of anisic acid. By John Scott Lumsden	14	87
10. The physical properties of heptoic, hexahydrobenzoic, and benzoic acids and their derivatives. By John Scott Lumsden	14	90
11. The influence of solvents on the rotation of optically active compounds. Part VII. Solution-volume and rotation of menthol and menthyl tartrates. By Thomas Stewart Patterson and Frances Taylor	15	122
February 2nd.		
12. Camphorylcarbimide. By Martin Onslow Forster and Hans Eduard Fierz	21	110
13. Configuration of *iso*nitrosocamphor and its unstable modification. By Martin Onslow Forster	22	232
14. The determination of molecular weight by lowering of vapour pressure. By Edgar Philip Perman	23	194
15. Note on β-NH ethenyldiaminonaphthalene. By Raphael Meldola and Joseph Henry Lane	24	—

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February 15th.		
16. Nitrogen halogen derivatives of the aliphatic diamines. By Frederick Daniel Chattaway	61	381
17. The nitration of substituted azophenols. By John Theodore Hewitt and Herbert Victor Mitchell	61	225
18. The estimation of saccharin. By Charles Proctor	62	242
19. The analysis of samples of milk referred to the Government Laboratory in connection with the Sale of Food and Drugs Acts. By Thomas Edward Thorpe	63	206
20. The condensation of anilinodiacetic esters in presence of sodium ethoxide. By Alfred Theophilus de Mouilpied	63	485
21. The basic properties of oxygen at low temperatures: additive compounds of the halogens with organic substances containing oxygen. By Douglas McIntosh	64	784
22. Organic derivatives of silicon. By Frederic Stanley Kipping	65	—
23. Photographic radiation of some mercury compounds. By Robert de Jersey Fleming Struthers and James Ernest Marsh	67	377
March 2nd.		
24. The relation between natural and synthetical glyceryl phosphoric acids. By Frederick Belding Power and Frank Tutin	72	249
25. The transmutation of geometrical isomerides. By Alfred Walter Stewart	73	—
26. Linin. By James Stuart Hills and William Palmer Wynne	74	327
27. The constitution of phenylmethylacridol. By James Johnston Dobbie and Charles Kenneth Tinkler	74	269
28. The ultra-violet absorption spectra of certain diazo-compounds in relation to their constitution. By James Johnston Dobbie and Charles Kenneth Tinkler	75	273
29. The latent heat of evaporation of benzene and some other compounds. By James Campbell Brown	75	265
30. The reduction of *iso*phthalic acid. By William Henry Perkin, jun., and Samuel Shrowder Pickles	75	293
31. The influence of temperature on the interaction between acetylthiocyanate and certain bases. Thiocarbamides, including carboxy-aromatic groups. By the late Robert Elliott Doran (compiled by Augustus Edward Dixon)	77	331
32. The influence of solvents on the rotation of optically active compounds. Part VIII. Ethyl tartrate in chloroform. By Thomas Stewart Patterson	78	313
33. A further note on the addition of sodium hydrogen sulphite to ketonic compounds. By Alfred Walter Stewart	78	—

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34. Action of hydrogen peroxide on carbohydrates in the presence of ferrous sulphate. Part V. By Robert Selby Morrell and Albert Ernest Bellars	79	280
35. Studies in chlorination. The chlorination of the isomeric chloronitrobenzenes. By Julius Bereud Cohen and Hugh Garner Bennett	80	320
March 15th.		
36. The velocity of oxime formation in certain ketones. By Alfred Walter Stewart	84	410
37. The ultra-violet absorption spectra of certain enol-keto-tautomerides. Part II. By Edward Charles Cyril Baly and Cecil Henry Desch	84	766
38. Esterification constants of substituted acrylic acids. By John Joseph Sudborough and David James Roberts	86	1840
39. α-Chlorocinnamic acids. By John Joseph Sudborough and Thomas Campbell James	86	105*
40. Diortho-substituted benzoic acid. Part VI. Conversion of methyl into ethyl esters. By John Joseph Sudborough and Thomas Huws Davies	87	—
41. Simple method for the estimation of acetyl groups. By John Joseph Sudborough and Walter Thomas	88	1752
42. Gynocardin, a new cyanogenetic glucoside. By Frederic Belding Power and Frederic Herbert Lees	88	349
43. Catechin and acacatechin. Supplementary note. By Arthur George Perkin	89	398
44. The action of ethyl dibromopropanetetracarboxylate on the disodium derivative of ethyl propanetetracarboxylate. A correction. By William Henry Perkin, jun.	90	358
45. Glutaconic acid and the conversion of glutaric acid into trimethylenedicarboxylic acid. By William Henry Perkin, jun., and George Tattersall	90	361
46. The transformations of highly substituted nitroaminobenzenes. By Kennedy Joseph Previté Orton and Alice Emily Smith	91	389
47. An asymmetric synthesis of quadrivalent sulphur. By Samuel Smiles	92	450
48. The action of α-halogen ketones on alkyl sulphides. By Samuel Smiles	93	—
49. Pinene *iso*nitrosocyanide and its derivatives. By William Augustus Tilden and Harry Burrows	94	344
50. Some interactions of metallic cyanides with organic bases. By Robert de Jersey Fleming Struthers	95	—
April 6th.		
51. The kinetics of chemical changes which are reversible. The decomposition of *as*-dimethylcarbamide. By Charles Edward Fawsitt	115	494
52. A new formation of acetylcamphor. By Martin Onslow Forster and Hilda Mary Judd	116	368

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53. Preparation and properties of 1 : 4 : 5-trimethylglyoxaline. By Hooper Albert Dickinson Jowett	116	405
54. Bromomethyl heptyl ketone. By Hooper Albert Dickinson Jowett	117	—
55. Limonene nitrosocyanides and their derivatives. By Frederick Peacock Leach	117	413
56. The action of carbon monoxide on ammonia. By Herbert Jackson and Dudley Northall-Laurie	118	433
57. The action of acetylene on aqueous and hydrochloric acid solutions of mercuric chloride. By John Samuel Strafford Brame	119	427
58. The basic properties of oxygen at low temperatures. Additive compounds of the halogens with organic substances containing oxygen. By Douglas McIntosh	120	784
59. Note on the interaction of metallic cyanides and organic halides. By Nevil Vincent Sidgwick	120	—
60. The chemical dynamics of the reactions between sodium thiosulphate and organic halogen compounds. Part II. Halogen substituted acetates. By Arthur Slator	121	481
61. The tautomerism of acetyl thiocyanate. By Augustus Edward Dixon and John Hawthorne	121	468
62. A method of determining the specific gravity of soluble salts by displacement in their own mother liquor, and its application in the case of the alkali halides. By John Young Buchanan	122	—
63. The combination of mercaptans with unsaturated ketonic compounds. By Siegfried Ruhemann	123	461
64. The existence of a carbide of magnesium. By J. Trengove Nance	124	—
65. Isomeric salts of the type $NR_1R_2H_2$. A correction. Isomeric forms of *d*-bromo- and *d*-chloro-camphor sulphonic acids. By Frederic Stanley Kipping	124	628
66. Isomerism of α-bromo- and α-chloro-camphor. By Frederic Stanley Kipping	125	—
67. *l*-Phenylethylamine. By Frederic Stanley Kipping and Albert Edward Hunter	126	—
68. The influence of the hydroxyl and alkoxyl groups on the velocity of saponification. Part I. By Alexander Findlay and William Ernest Stephen Turner	127	747
April 19th.		
69. Complex nitrites of bismuth. By Walter Craven Ball.	129	761
70. Experiments on the synthesis of the terpenes. Part II. Synthesis of Δ^3-*p*-menthenol(8), $\Delta^{3:8(9)}$-*p*-menthadiene, *p*-menthenol(8), $\Delta^{8(9)}$-*p*-menthene, and *p*-menthane. By William Henry Perkin, jun., and Samuel Shrowder Pickles	130	639

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71. Experiments on the synthesis of the terpenes. Part III. Synthesis of aliphatic compounds similar in constitution to terpineol and dipentene. By William Henry Perkin, jun., and Samuel Shrowder Pickles...	131	655
72. Experiments on the synthesis of the terpenes. Part IV. Synthesis of Δ^3-normenthenol(8), $\Delta^{2:8(9)}$-normenthadiene, normenthanol(8), and $\Delta^{8(9)}$-normenthene. By Kōichi Matsubara and William Henry Perkin, jun.	131	661
73. *C*-Phenyl-*s*-triazole. By George Young	131	625
74. The resolution of inactive glyceric acid by fermentation and by brucine. By Percy Faraday Frankland and Edward Done	132	618
75. Estimation of potassium permanganate in the presence of potassium persulphate. By John Albert Newton Friend	133	738
May 4th.		
76. Notes on sodium alum. By John Mello Wadmore	150	—
77. Camphoryl-ψ-semicarbazide. By Martin Onslow Forster and Hans Eduard Fierz	151	722
78. Some derivatives of anhydracetonebenzil. By Francis Robert Japp and Joseph Knox	152	673
79. The dihydrocyanides of benzil and phenanthraquinone. Second notice. By Francis Robert Japp and Joseph Knox	153	681
80. A condensation product of mandelonitrile. By Francis Robert Japp and Joseph Knox	153	701
81. Action of hydrazine on unsaturated γ-diketones. By Francis Robert Japp and James Wood	154	707
82. The synthesis of substances allied to adrenaline. By Henry Drysdale Dakin	154	—
83. Methylation of *p*-aminobenzoic acid by means of methyl sulphate. Preliminary note. By John Johnston	156	—
84. The atomic weight of nitrogen. Preliminary notice. By Robert Whytlaw Gray	156	1601
85. The methylation of gallotannic acid. By Otto Rosenheim	157	—
86. The interaction of hydrogen sulphide and sulphur dioxide. By William Robert Lang and Charles Macdonald Carson	158	—
87. The formula of cyanomaclurin. By Arthur George Perkin	160	715
May 17th.		
88. The desmotropic form of substances of the ethyl acetoacetate type in the homogeneous state and dissolved in neutral media. By Julius Wilhelm Brühl and Heinrich Schröder	164	—

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89. The chlorination of methyl derivatives of pyridine Part I. 2-Methylpyridine. By William James Sell	165	799
90. The absorption spectra of uric acid, murexide, and the ureides, in relation to colour, and their chemical structure. By Walter Noel Hartley	166	1791 1796
91. Observations on chemical structure and physical properties associated with the theory of colour. By Walter Noel Hartley	167	1822
92. Further studies on dihydroxymaleic acid. By Henry John Horstman Fenton	168	804
93. The influence of light on diazo-reactions. Preliminary notice. By Kennedy Joseph Previté Orton and Joseph Edward Coates and (in part) Frances Burdett.	168	—
94. Behaviour of solutions of propyl alcohol towards semi-permeable membranes. By Alexander Findlay and Frederick Charles Short	170	819
95. The thermal decomposition of formaldehyde and acetaldehyde. By William Arthur Bone and Henry Llewellyn Smith	171	910
96. The synthesis of formaldehyde. By David Leonard Chapman and Alfred Holt, jun.	171	916
97. Oxymercuric perchlorates and the action of alcohol on mercury perchlorates. By Masumi Chikashigé	172	822
98. The constitution of pilocarpine. Part V. Conversion of *iso*pilocarpine into pilocarpine. By Hooper Albert Dickinson Jowett	172	794
June 1st.		
99. The constituents of the seeds of *Hydnocarpus Wightiana* and of *Hydnocarpus anthelmintica*. Isolation of a homologue of chaulmoogric acid. By Frederick Belding Power and Marmaduke Barrowcliff	175	884
100. The constituents of the seeds of *Gynocardia odorata*. By Frederick Belding Power and Marmaduke Barrowcliff	176	896
101. The relation of ammonium to the alkali metals. A study of ammonium magnesium and ammonium zinc sulphates and selenates. By Alfred Edwin Howard Tutton	177	1123
102. Camphorylazoimide. By Martin Onslow Forster and Hans Eduard Fierz	178	826
103. Influence of substitution on the formation of diazo-amines and aminoazo-compounds. Part III. Azo-derivatives of the symmetrically disubstituted primary meta-diamines. By Gilbert Thomas Morgan and William Ord Wootton	179	935
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—— *See* Handbuch der anorganischen Chemie.

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Wednesday, January 18th, 1905. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Messrs. T. R. Hodgson, J. K. H. Inglis, J. R. Johnson, and G. F. Phillips were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

James Henry Ashwell, 117, Waterloo Crescent, Nottingham.
Samuel Henry Clifford Briggs, B.Sc., Green Bank, Cleckheaton, Yorks.
F. E. Clarke, Ph.D., B.Sc., Pennsylvania State College, Pa., U.S.A.
Charles Richard Gardner, Green Cottage, Brunswick Square, Gloucester.
Frederick William Heely, 10, Yarborough Street, Grimsby.
James Alexander Russell Henderson, B.Sc., Chihli Provincial College, Paotingfu, N. China.
Percy Walter Jones, Toowong, Brisbane, Queensland.
Joseph Lister, B.Sc., 50, Portland Street, Lancaster.
Edward William Lucas, 37, Barton Street, Kensington, W.
Frank Lee Pyman, Ph.D., B.Sc., The Oaks, Hitchin, Herts.
Fred Scholefield, B.Sc., 9, Lyndhurst Villas, Magdalen Road, Norwich.
John Irwin Scott, B.A., Trent College, Long Eaton, Derbyshire.

William Dunham Seaton, 40, Argyle Road, Ilford, Essex.
William Herbert Simmons, B.Sc., Oakleigh, Stoke Newington Common, N.
Eric H. Weiskopf, Modderfontein, Transvaal.

The PRESIDENT gave notice that an EXTRAORDINARY GENERAL MEETING will be held in the Society's Rooms on **Wednesday, February 8th, 1905**, at **5.30 p.m.**, to consider the proposal of the Council to make alterations in the Bye-Laws.

The Council has ordered the following letter and report to be printed in the Journal and in the Proceedings of the Society:

GOVERNMENT LABORATORY,
CLEMENT'S INN PASSAGE,
STRAND, LONDON, W.C.
6th December, 1904.

GENTLEMEN,

I beg to hand you the Report of the International Committee on Atomic Weights, 1905, to which I have appended the names of Professors Moissan and Seubert, as desired by them.

Since the Report was signed I have received, in common I presume with other members of the Committee, a communication from a Committee of the German Chemical Society in reference to the adoption of only one table of numbers in which oxygen should be taken as O = 16, to the exclusion of a second table in which the values of the atomic weights were based on H = 1. On my communicating with the Chairman as to what action should be taken in consequence of the letter from the Berlin Committee I was informed that the Report as adopted had already been despatched to Japan, and was actually in print in America. In these circumstances, and as the Sub-Committee had not had any opportunity of taking the communication from the German Committee into consideration, he considered it desirable that the Report, as adopted, should be presented to the various Societies concerned.

I am, Gentlemen,

Your obedient Servant,

T. E. THORPE.

The Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights.

The International Committee on Atomic Weights respectfully submits the following report, together with a table of atomic weights for use during 1905.

Most of the values recommended in our table are identical with those reported in former years; but a few changes seem to be needed. Other changes, which are suggested by recent investigations, are deferred until fuller information regarding their desirability shall have been received. During 1904 there has been great activity in the determination of atomic weights; and a summary of the more important researches may help to explain our reasons for changing or retaining hitherto accepted values. The researches to be considered are as follows:

Glucinum.—Atomic weight redetermined by Parsons (*J. Amer. Chem. Soc.*, 1904, **26**, 721). Seven analyses of the acetylacetonate gave, in mean, Gl = 9·113. Nine analyses of the basic acetate gave exactly the same average. As the individual determinations range from 9·081 to 9·142, the figure 9·1 may evidently remain unchanged.

Indium.—The investigation by Thiel (*Zeit. anorg. Chem.*, 1904, **40**, 280) shows that the atomic weight of indium is higher than had been supposed. Analyses of the trichloride gave, in mean, In = 115·05. Analyses of the tribromide gave 114·81. With the oxide, unsatisfactory results were obtained. For present purposes the round number 115 may be adopted, although further investigation is promised by Thiel, and a research by Dennis and Geer is in progress.

Iodine.—In our former reports we have noted the uncertainty in the accepted atomic weight of iodine. Stas, by the synthesis of AgI, found I = 126·85. Scott, by the same general method, found I = 126·97; and Ladenburg, by measuring the ratio AgI : AgCl, obtained the value 126·96. Koethner and Aeuer (*Ber.*, 1904, **37**, 2536), from data given by several methods, including a repetition of Ladenburg's process, conclude that the atomic weight of iodine cannot be less than 126·963; but the full details of their investigation, at the date of writing this report, are still unpublished. A more recent research by G. P. Baxter will soon appear, in which the higher value for iodine is completely confirmed, both by Ladenburg's method and by that of Stas. Baxter's final value is I = 126·975; and there can now be no reasonable doubt that the Stas figure is too low. The number 126·97 is adopted in our table for O = 16, or 126·01 with hydrogen as unity.

Nitrogen.—The accepted value for the atomic weight of nitrogen, 14·04, is derived mainly from the work of Stas. Of late years, how-

ever, the study of gaseous densities has led several physicists, notably Rayleigh, Leduc, and Daniel Berthelot, to the belief that the true value is but little in excess of the round number 14. Guye (*Compt. rend.*, 1904, **138**, 1213) finds from the density of nitrogen the value 14·004. Still more recently, Guye and Bogdan (*ibid.*, **138**, 1494), by analysis of nitrous oxide, have found N = 14·007. Jaquerod and Bogdan (*ibid.*, **139**, 49) have also studied nitrous oxide volumetrically, and obtained the figure 14·019. In view of the discordance between the volumetric and the gravimetric data, it seems undesirable to make any change at present in the number assigned to nitrogen. Further investigation of this atomic weight is evidently needed.

Rubidium.—Atomic weight redetermined by Archibald (*Trans.*, 1904, **85**, 776) from analyses of the chloride and bromide. The final mean, derived from many concordant experiments, is Rb = 85·485. As some of the determinations are slightly higher than 85·5, that figure may be adopted as sufficiently accurate for all practical purposes.

Samarium.—Urbain and Lacombe (*Compt. rend.*, 1904, **138**, 1166), by analyses of the octahydrated sulphate, find Sm = 150·34. A comparison of this figure with the older determinations justifies the use of 150·3 as the most probable value for this atomic weight. The same authors (*ibid.*, **138**, 627) have also determined the atomic weight of europium, and give the figure Eu = 151·79. It is desirable, however, to await more complete information about europium before recognising it in the table.

Thorium.—Evidence as to the complex nature of ordinary "thorium" is steadily accumulating. According to Baskerville (*J. Amer. Chem. Soc.*, 1904, **26**, 922), it is a mixture of at least three elements, which he calls carolinium, thorium, and berzelium. Their approximate atomic weights are 256, 220, and 212·5 respectively, supposing them all to be tetrads. The value in our table is that of ordinary thorium, as it is found in mineral analyses; and no change can safely be made until our knowledge has become more definite.

Tungsten.—The figure commonly assigned to tungsten, W = 184, has been verified by Smith and Exner (*Proc. Amer. Phil. Soc.*, 1904, **43**, 123). From twenty-seven measurements of the ratio $WCl_6 : WO_3$, W = 184·04. From twenty-three syntheses of WO_3, W = 184·065. The individual determinations range from 183·94 to 184·14, which is a fair degree of concordance for so high an atomic weight.

Changes, then, are recommended in the cases of indium, iodine, rubidium, and samarium. The column of atomic weights referred to the hydrogen unit has also been carefully recalculated, and in it some small alterations appear. The latter modifications, however, are unimportant, except in so far as they help to bring the two tables into greater harmony.

During the year there has been a revival of the agitation over the question of standards; and the policy of this committee, or rather sub-committee of the larger international body, in publishing a double table, has encountered some criticism. That criticism is perfectly legitimate, and we are glad to say that it has been expressed courteously, and in a truly scientific spirit. Professors Sakurai and Ikeda (*Chem. News*, 1904, **89**, 305) have published an open letter upon the subject,* and, in response to a demand within the German Chemical Society, the committee representing that body issued a circular to the members of the larger International Committee, asking for an expression of opinion as to our procedure. We are not yet informed regarding the responses to that circular, and we therefore cannot base any action upon it. The Council of the American Chemical Society has also, by a formal vote, requested this committee to ask for instructions from the larger body, both as to the use of a double standard and as to the nomenclature and symbols of glucinum or beryllium, and columbium or niobium. With this request we now comply, and hope that every member of the larger International Committee on Atomic Weights will send in his opinion upon the questions thus raised. Shall we continue to issue a double table? Can uniformity in symbols and nomenclature be obtained? And which names are preferable, in the light of history, evidence, and international usage, for the two elements under discussion?

That a single standard for atomic weights is most desirable, every chemist will admit, but two standards actually exist, and each one is represented by earnest advocates who are unwilling to give way. Each side of the controversy is supported by eminent authorities in nearly equal numbers, and no agreement seems to be possible either at present or within the near future. This condition of affairs the present committee has been compelled to face, and to deal with things as they are instead of as we should like them to be. Two tables of atomic weights exist, and it has therefore seemed wisest to recognise the needs of both parties in the controversy, and to furnish each with trustworthy data for practical use. It is surely better to have one committee prepare both tables, than to leave this work to be done in accordance with individual preferences. That there are difficulties in adjusting one table to the other is perfectly evident; but the resulting confusion is, we think, less serious than some of our critics would have us believe. The confusion is certainly less than it would be were the individual advocates of either standard to attempt the adjustment of one to the other independently. In short, the real question now before us seems to be this: Shall the present committee act in

* See reply by F. W. Clarke in *Chem. News*, **90**, 56, July 29, 1904.

a quasi-judicial manner, recognising both parties in controversy, or shall it assume a partisan position and represent one alone?

F. W. Clarke.
Henri Moissan.
Karl Seubert.
T. E. Thorpe.

International Atomic Weights.

		O=16.	H=1.			O=16.	H=1.
Aluminium	Al	27·1	26·9	Neodymium	Nd	143·6	142·5
Antimony	Sb	120·2	119·3	Neon	Ne	20	19·9
Argon	A	39·9	39·6	Nickel	Ni	58·7	58·3
Arsenic	As	75·0	74·4	Nitrogen	N	14·04	13·93
Barium	Ba	137·4	136·4	Osmium	Os	191	189·6
Bismuth	Bi	208·5	206·9	Oxygen	O	16·00	15·88
Boron	B	11	10·9	Palladium	Pd	106·5	105·7
Bromine	Br	79·96	79·36	Phosphorus	P	31·0	30·77
Cadmium	Cd	112·4	111·6	Platinum	Pt	194·8	193·3
Cæsium	Cs	132·9	131·9	Potassium	K	39·15	38·85
Calcium	Ca	40·1	39·7	Praseodymium	Pr	140·5	139·4
Carbon	C	12·00	11·91	Radium	Rd	225	223·3
Cerium	Ce	140·25	139·2	Rhodium	Rh	103·0	102·2
Chlorine	Cl	35·45	35·18	Rubidium	Rb	85·5	84·9
Chromium	Cr	52·1	51·7	Ruthenium	Ru	101·7	100·9
Cobalt	Co	59·0	58·55	Samarium	Sm	150·3	149·2
Columbium	Cb	94	93·3	Scandium	Sc	44·1	43·8
Copper	Cu	63·6	63·1	Selenium	Se	79·2	78·6
Erbium	Er	166	164·7	Silicon	Si	28·4	28·2
Fluorine	F	19	18·9	Silver	Ag	107·93	107·11
Gadolinium	Gd	156	154·8	Sodium	Na	23·05	22·88
Gallium	Ga	70	69·5	Strontium	Sr	87·6	86·94
Germanium	Ge	72·5	72	Sulphur	S	32·06	31·82
Glucinum	Gl	9·1	9·03	Tantalum	Ta	183	181·6
Gold	Au	197·2	195·7	Tellurium	Te	127·6	126·6
Helium	He	4	4	Terbium	Tb	160	158·8
Hydrogen	H	1·008	1·000	Thallium	Tl	204·1	202·6
Indium	In	115	114·1	Thorium	Th	232·5	230·8
Iodine	I	126·97	126·01	Thulium	Tm	171	169·7
Iridium	Ir	193·0	191·5	Tin	Sn	119·0	118·1
Iron	Fe	55·9	55·5	Titanium	Ti	48·1	47·7
Krypton	Kr	81·8	81·2	Tungsten	W	184	182·6
Lanthanum	La	138·9	137·9	Uranium	U	238·5	236·7
Lead	Pb	206·9	205·35	Vanadium	V	51·2	50·8
Lithium	Li	7·03	6·98	Xenon	Xe	128	127
Magnesium	Mg	24·36	24·18	Ytterbium	Yb	173·0	171·7
Manganese	Mn	55·0	54·6	Yttrium	Yt	89·0	88·3
Mercury	Hg	200·0	198·5	Zinc	Zn	65·4	64·9
Molybdenum	Mo	96·0	95·3	Zirconium	Zr	90·6	89·9

Of the following papers, those marked * were read :—

***1. "Nitrogen halogen derivatives of the sulphonamides." By Frederick Daniel Chattaway.**

The nitrogen halogen derivatives of the sulphonamides, which are obtained by the action of hypochlorous acid on the sulphonamides and the alkylsulphonamides, are remarkable for the great ease with which they can be prepared and crystallised, and for their comparative stability. The sulphondichloroamides all react with alkali hydroxides, forming the corresponding hypochlorite and the salts of the sulphonmonochloroamides. The latter salts, which are well crystallised and frequently contain water of crystallisation, only slowly undergo further hydrolysis. They have, in all probability, the *iso*-structure.

The sulphondichloroamides, alkali sulphonmonochloroamides, and sulphonalkylchloroamides easily enter into all the reactions characteristic of nitrogen chlorides, and illustrate exceptionally well the behaviour of the nitrogen halogen linking, as the various types of simple interaction may with these substances be studied uncomplicated by the transformations which so readily occur with unsubstituted acylphenylchloroamides.

Sulphondibromoamides and sulphonalkylbromoamides are obtained most easily by a method analogous to that by which the corresponding sulphonchloroamides are prepared; that is, by the action of hypobromous acid on the corresponding amides (compare Hoogewerff and van Dorp, *Rec. Trav. Chim.*, 1887, **6**, 373; 1889, **8**, 173). They resemble the chloroamides in many of their properties, but are not so stable, and have a bright yellow or orange colour. The dibromoamides, which crystallise well and can be kept for some days unchanged, slowly decompose on longer keeping, bromine being generally liberated. When warmed with solutions of alkali hydroxides, they form salts, one bromine atom being replaced by metal. These salts are beautifully crystalline, pale yellow substances frequently containing water of crystallisation, which is lost at 100°; when more strongly heated, they decompose explosively. As in the salts of the chloroamides, the metal is probably attached to oxygen.

A large number of typical examples of these compounds were described.

***2. "Electrolytic oxidation of the aliphatic aldehydes." By Herbert Drake Law.**

The chief product of oxidation of the lower members of the saturated aliphatic aldehydes is the corresponding organic acid. To a smaller

extent, the oxidation proceeds further, carbon dioxide and carbon monoxide being formed, and in the cases of acetaldehyde and propaldehyde small quantities of saturated hydrocarbons are also produced: $RCOH + O = RH + CO_2$. No corresponding reaction takes place in the cases of formaldehyde and *iso*butaldehyde.

In these experiments, sulphuric acid was used as electrolyte. The gaseous products were collected in Hofmann's electrolytic apparatus fitted with platinum electrodes. The amount of acid formed was estimated in a porous pot fitted with a rotating platinum stirrer.

Discussion.

Dr. F. M. Perkin said that one of the most interesting points brought out in the paper was the formation of small quantities of hydrocarbons in an oxidation process. It was remarkable how extremely stable the aldehydes were to electrolytic oxidation. This was shown most strikingly in the case of the aromatic aldehydes. Thus, if a mixture of toluene and benzaldehyde was subjected to electrolytic oxidation, the hydrocarbon was oxidised in preference to the aldehyde (*Trans. Faraday Soc.*, 1904, 31). Some of the oxidations were best explained by supposing that the hydroxyl group and not free oxygen took part in the reaction, as, for example, in the formation of methyl alcohol in the electrolytic oxidation of an alkali acetate (*Annalen*, 1902, 323, 304).

***3. "The diazo-derivatives of the benzenesulphonylphenylenediamines." By Gilbert Thomas Morgan and Frances Mary Gore Micklethwait.**

Benzenesulphonyl-p-*phenylenediamine*, $PhSO_2 \cdot NH \cdot C_6H_4 \cdot NH_2$ (m. p. 173°), when diazotised in hydrochloric acid, yields a stable, colourless *diazonium chloride*, $PhSO_2 \cdot NH \cdot C_6H_4 \cdot N_2Cl$, which, on treatment with aqueous alkalis or sodium acetate, condenses to form a yellow *diazoimide*, $C_6H_4 \cdot [N_2] \cdot SO_2Ph$ (m. p. 155°), this substance being produced directly when the base and nitrous acid interact in glacial acetic acid.

The corresponding ortho-compound (m. p. 165—167°), when treated with nitrous acid either in hydrochloric or glacial acetic acid solution, at once gives rise to a colourless cyclic *diazoimide* (m. p. 130°); in this case, the intermediate diazonium salt could not be isolated.

When the iminic hydrogen atom of the $PhSO_2 \cdot NH$ group in the foregoing bases is replaced by methyl, the resulting compounds, *benzenesulphonylmethyl*-p-(and -o-)-*phenylenediamines*, yield diazonium salts, $PhSO_2 \cdot NMe \cdot C_6H_4 \cdot N_2Cl$, which do not condense to form diazoimides;

these products were characterised by the formation of their azo-β-naphthol derivatives.

Benzenesulphonyl-m-*phenylenediamine* (m. p. 98—99°) differs greatly from its ortho- and para-isomerides in its behaviour towards nitrous acid; in hydrochloric acid, it yields a diazonium chloride which, when freed from excess of acid or when treated with aqueous sodium acetate, evolves nitrogen and becomes converted into an azo-derivative approximating in composition to the formula

$$PhSO_2 \cdot NH \cdot C_6H_4 \cdot N_2 \cdot C_6H_3(OH) \cdot NH \cdot SO_2Ph.$$

This change no longer occurs when the iminic hydrogen is replaced by methyl, and as-*benzenesulphonylmethyl*-m-*phenylenediamine* (m. p. 96°), like its ortho- and para-isomerides, yields successively a normal diazonium salt and an azo-β-naphthol derivative (m. p. 129—131°).

Discussion.

Dr. Cain mentioned that he had diazotised large quantities of *p*-aminoacetanilide in the manufacture of Coomassie Black, but had not noticed the formation of substances analogous to those described by the authors. Their failure to diazotise an amino-group in the ortho-position to a mono-substituted amino-group was in accordance with the work of other investigators on such compounds.

Dr. Hewitt agreed with Dr. Morgan respecting the probably essential difference in structure of the compounds obtained by the action of nitrous acid on the monobenzenesulphonyl derivatives of *o*- and *p*-phenylenediamines. Of the two cyclic formulæ proposed for the ortho-compound, that in which a quinquevalent nitrogen atom was assumed seemed, however, very improbable; nitrogen, as far as we know, only becoming quinquevalent in the case of salt formation.

Dr. Morgan, in reply, said that as benzenesulphonyl-*p*-phenylenediamine had been found to yield a new type of diazoimide, it became of interest to ascertain the behaviour of the similarly substituted ortho- and meta-diamines under comparable conditions.

With reference to the alternative diazonium formula for the ortho-diazoimide, it seemed necessary to consider this possible configuration, inasmuch as, on account of the distinctly acidic nature of the complex $C_6H_5 \cdot SO_2 \cdot NH$, the condensation of this substituent with the adjacent basic diazonium group might be regarded as involving the formation of an internal salt.

***4. "The molecular condition in solution of ferrous potassium oxalate." By Samuel Edward Sheppard and Charles Edward Kenneth Mees.**

Ferrous oxalate dissolves in alkali oxalates, forming double salts, such as $K_2Fe(C_2O_4)_2$, which dissociate according to the scheme

$$2\overset{+}{K} + \overline{Fe(C_2O_4)_2}.$$

The complex anion, $\overline{Fe(C_2O_4)_2}$, is not very stable, and by solubility determinations the value 0·8 was found for the constant

$$K = \frac{C_{\overline{Fe(C_2O_4)_2}}}{C_{\overline{C_2O_4}}}$$

at 20°.

Spectrophotometric measurements showed that the formation of ferrous ions at moderate dilutions was negligibly small.

The action of acids is to precipitate ferrous oxalate by removing free oxalate ions, thus disturbing the equilibrium indicated above.

The absorption-spectrum was measured at three concentrations. The absorption is unilateral, increasing uniformly toward the violet end of the spectrum.

***5. "A further analogy between the asymmetric nitrogen and carbon atoms." By Humphrey Owen Jones.**

In the present state of our knowledge of the stereoisomerism of quinquevalent nitrogen compounds, any definite knowledge about the similarity and difference between them and asymmetric carbon compounds is of value. The author has proved that, during the formation of an asymmetric nitrogen atom in a compound containing an asymmetric carbon atom, two isomerides, which are called the α- and β-compounds, are produced. Methyl-*l*-amylaniline has been combined with allyl and benzyl iodides.

The dextrorotatory α-allyl compound can be isolated by crystallisation from alcohol; $[\alpha]_D$ in chloroform = 21·8°, gradually falling to 3·1° as the α-isomeride changes into the β-derivative until equilibrium is attained.

The two benzyl compounds cannot be separated in the same way, because the difference in solubility is not great, and they are very labile. They have therefore been separated by means of their camphorsulphonates. α-Phenylbenzylmethyl-*l*-amylammonium iodide melts at 144—145° and has $[\alpha]_D$ in chloroform = 65°; the β-compound melts at 131—132° and has $[\alpha]_D = -18·8°$.

The chloroform solutions of both compounds change rapidly until equilibrium is attained with $[\alpha]_D = 2·8°$.

6. **"The formation of magnesia from magnesium carbonate by heat and the effect of temperature on the properties of the product." By William Carrick Anderson.**

Magnesia prepared from different substances and by different methods is known to vary greatly in properties, and it is generally supposed that this is due either to variation in the size of the molecule of the oxide, or to a difference in the grouping of the magnesium and oxygen atoms in the molecule, or to both of these causes. In the absence of a method of determining the molecular weights of solid substances, evidence in support of the view that the magnesia is polymerised must be indirect.

Experiments were conducted on the native magnesium carbonate (magnesite) and on three forms of artificial carbonate with the view of ascertaining (1) the lowest temperature at which the evolution of carbon dioxide could be distinctly recognised; (2) the comparative rates at which the expulsion of the gas takes place at higher temperatures under atmospheric pressure; and (3) the extent to which the samples of magnesia thus obtained dissolve in water after being kept at different known temperatures for a fixed period. This solubility was determined after leaving an excess of the specimen in water for 2 hours at 20°.

In 20 hours at 350°, native magnesite yielded a quantity of carbon dioxide equal to 0·40 per cent. of its weight, and the rate of evolution increased rapidly with rise of temperature. Complete expulsion was reached at about 750° with two at least of the artificial carbonates, but only above 810° in the case of the third ("heavy carbonate").

The rate of solution of the magnesia obtained by heating the "heavy carbonate" was found to be greater than that of the samples obtained from "light" and "crystal" carbonate under the same conditions, so long as the heating was little more than that needed for complete decomposition of the carbonates. As the temperatures of preparation were increased, the rate of solution diminished in every instance, but much more rapidly in the case of the "heavy" oxide than in those of the other two.

It is inferred from these results that polymerisation takes place when magnesia is heated, and that this goes on faster in the dense "heavy" oxide than in the lighter specimens of magnesia. The rate of solution as determined in the experiments is believed to be a measure of the rate of hydration, and this appears to be most rapid in the molecule $(MgO)_n$ obtained by heating the heavy carbonate at 810°.

7. "Transformations of derivatives of *s*-tribromodiazobenzene." By Kennedy Joseph Previté Orton.

The discrepancy between the results obtained by the author (*Proc. Roy. Soc.*, 1902, **71**, 153; Trans., 1903, **83**, 796) and by Hantzsch (Hantzsch and Pohl, *Ber.*, 1902, **35**, 2964; and Hantzsch, *Ber.*, 1903, **36**, 2069) with respect to the transformations of *s*-tribromobenzenediazonium salts and *s*-tribromobenzenediazotates has led the author to reinvestigate these reactions.

According to the author, in solutions of the diazonium salts of weak acids, that is, solutions in which the ions $(C_6H_2Br_3\cdot N_2)^{\cdot}$ and $(OH)'$ are simultaneously present, a replacement of a bromine atom by hydroxyl takes place, bromine ions appearing in the solution, and 3 : 5-dibromo-*o*-benzoquinonediazide (3 : 5-dibromodiazophenol), $O{:}C_6H_2Br_2{:}N_2$, being formed. A similar decomposition takes place when a solution of the corresponding *s*-tribromobenzenediazotate is treated with quantities of an acid insufficient to convert the diazo-compound into the diazonium salt, the free diazohydroxide, $C_6H_2Br_3\cdot N{:}N\cdot OH$, thus formed, probably now cleaving into the groups $(C_6H_2Br_3\cdot N_2)^{\cdot}$ and $(OH)'$.

According to Hantzsch, on the other hand, under both conditions the primary product of the change is *s*-tribromophenylnitrosoamine, $C_6H_2Br_3\cdot NH\cdot NO$, a substance which, although at first thought to be readily capable of isolation (*Ber.*, 1902, **35**, 2964), is now stated (*Ber.*, 1903, **36**, 2069) to be unstable and, at any but low temperatures, liable to decompose into the quinonediazide with the elimination of hydrogen bromide.

The difference between these two results is ascribed by Hantzsch to the fact that the author carried out his experiments at the ordinary temperature and not at as low a temperature as possible.

In the new experiments, the solutions have been kept partially frozen during the reaction, and the primary product has been examined in order to ascertain if any decomposition, which was accompanied by the formation of quinonediazide and the elimination of hydrogen bromide, could be detected. The author's earlier observations, namely, that the primary product was a mixture of a complex condensation product with the quinonediazide, were completely confirmed.

The proportion of the quinonediazide in the primary yellow product was estimated by conversion into the azo-β-naphthol derivative, and found to represent about 12 per cent. of the diazonium hydrogen sulphate, when 2 gram-mols. of hydrogen carbonate were used for each gram-mol. of diazonium salt; at the same time, it was shown that the quinonediazide did not arise during the operation from the decomposition of *s*-tribromophenylnitrosoamine, as no simultaneous formation of hydrogen bromide could be detected.

In the yellow aqueous extract of the primary product, which, according to Hantzsch, contains the nitrosoamine in solution, the author was unable to find any substance but the quinonediazide. On keeping or on heating, no decomposition accompanied by the elimination of hydrogen bromide was observed; the diazophenol could be completely extracted from the solution by chloroform and then coupled with alcoholic β-naphthol; lastly, when exposed to light, the solution behaved in the manner characteristic of diazophenols.

Experiments showed that between the limits of 0° and 15° temperature has but little effect on the extent of the decomposition of the *s*-tribromodiazobenzene; as the author has previously stated, the prime factors appear to be the concentrations of the ions $(C_6H_2Br_3 \cdot N_2)^{\cdot}$ and $(OH)'$.

The author sees, therefore, no reason for modifying the views expressed by him in former papers as to the mechanism of this reaction, and thinks that at present there is not sufficient evidence for supposing that a nitrosoamine is the primary product, which subsequently decomposes into quinonediazide and hydrogen bromide.

8. "The addition of sodium hydrogen sulphite to ketonic compounds." By Alfred Walter Stewart.

The statement made by Beilstein in his *Handbuch* (3rd ed., I, 999), that pinacoline forms no addition product with sodium hydrogen sulphite, when taken in conjunction with the current idea that "bisulphite" compounds are formed only with those ketones which contain the acetyl group, suggests that the introduction of methyl groups into the ketonic chain has a tendency to prevent the formation of an additive product. With the view of testing the correctness of this idea, and in order to estimate the relative amounts of the double compounds formed with different ketones, advantage was taken of the fact that iodine solution does not oxidise the SO_3Na group of a ketonic bisulphite compound. Thus, if two solutions, one of pure sodium hydrogen sulphite and the other containing a mixture of this salt and a ketonic compound, are titrated, the difference in the number obtained on titration indicates the amount of additive product formed. This method was applied to several compounds containing the acetyl group and the principal results are shown in the following table:

	Percentage of bisulphite compound formed in			
	10 minutes.	30 minutes.	50 minutes.	70 minutes.
Acetaldehyde	85·0	88·0	88·7	88·7
Acetone	28·5	47·0	55·9	58·9
Methyl ethyl ketone	14·5	25·1	32·4	38·4
Methyl propyl ketone.....	8·5	14·8	19·6	25·5
Methyl *iso*propyl ketone.....	4·2	7·5	11·6	13·0
Pinacoline	4·2	5·6	5·6	5·6

9. "The reduction products of anisic acid." By John Scott Lumsden.

When anisic acid dissolved in amyl alcohol is reduced by sodium, the products of reduction are hexahydrobenzoic acid and δ-ketohexahydrobenzoic acid. The formation of the former acid is explained by the removal of the methoxy-group of anisic acid and the complete hydrogenation of the ring, but the production of the δ-ketonic acid is more difficult to understand, being probably due to four hydrogen atoms becoming attached, and then, by the agency of one molecule of water, the methyl group is removed as methyl alcohol, and the hydrogen of the water is added to the γ-carbon atom. By analysis of the ketonic acid and its salts and from the melting point of the semicarbazone, it is proved to be identical with the acid recently prepared synthetically by Perkin (Trans., 1904, **85**, 416).

10. "The physical properties of heptoic, hexahydrobenzoic, and benzoic acids and their derivatives." By John Scott Lumsden.

From hexahydrobenzoic acid, which was obtained pure from anisic acid, the methyl, ethyl, and propyl esters, the acid chloride and anhydride, and the amide and anilide were prepared and their properties compared with the corresponding compounds of heptoic and benzoic acids. It was found that the properties of hexahydrobenzoic acid and its derivatives were in general intermediate between those of the other two acids, the melting points, boiling points, specific gravities, and refractive indices being higher than those of the heptoic, and lower than those of the benzoic acid series.

The solubilities of the three acids are nearly alike, but the affinity constant of the hexahydro-acid is lower than that of benzoic acid, and is like the value of that of an acid of the fatty series. The boiling points of the hexahydro-compounds are regularly 9° higher than the heptoic, and 15° lower than the corresponding benzoic derivatives. A comparison of the molecular volumes showed that a hexamethylene ring and a benzene nucleus have identical volumes, while measurements with a Pulfrich's refractometer proved that the hexamethylene structure has no influence on the refraction of light, but that a benzene nucleus retards light to an amount equal to that due to six hydrogen atoms, thus making the molecular refractions of the corresponding derivatives of benzoic and hexahydrobenzoic acid identical.

11. **"The influence of solvents on the rotation of optically active compounds. Part VII. Solution-volume and rotation of menthol and menthyl tartrates." By Thomas Stewart Patterson and Francis Taylor.**

The authors have examined the rotation of menthol, *l*-menthyl *d*-tartrate, and *l*-menthyl diacetyl-*d*-tartrate in ethyl alcohol, benzene, and nitrobenzene, and have compared the values obtained with the corresponding values for molecular-solution-volume. The results were considered, on the whole, to confirm the suggestion that rotation in solution and molecular-solution-volume are closely related phenomena. For menthol, the facts are in complete agreement with theory. With menthyl tartrate, the results for alcohol and nitrobenzene are in good agreement, although the relationship between the two variables in benzene is anomalous. Difficulties are met with also for menthyl diacetyltartrate; but although in alcohol and benzene the relationship is not a quantitative one, it is in accordance with theory in so far as, in both cases, contraction brings about increased rotation. Out of the nine examples studied, seven are in agreement with the relationship suggested.

ALTERATION OF LIBRARY RULE 4.

Instead of:—

"New Books are not available for circulation till two months after their names have appeared in the Proceedings."

The Rule now reads:—

"A Book may not be taken out of the Library until one month after it has been received."

ADDITIONS TO THE LIBRARY.

I. Donations.

Internationaler Kongress für angewandte Chemie (V). Berlin, Juni 1903. Bericht erstattet vom Präsidenten des Kongresses Otto N. Witt, und dem wissenschaftlichen Sekretär des Kongresses Georg

Pulvermacher. 4 Bände. pp. xii + 795, xii + 1021, xii + 1075, xv + 1156. ill. Berlin 1904. (*Recd.* 7/1/05.) From the Congress.

Wardle, Sir Thomas. Kashmir: its new silk industry, with some account of its natural history, geology, sport, etc. pp. xx + 363. ill. London 1904. (*Recd.* 12/1/05.) From the Author.

II. By Purchase.

Bunsen, Robert. Gesammelte Abhandlungen. Im Auftrage der Deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie, herausgegeben von Wilhelm Ostwald und Max Bodenstein. 3 Bände. pp. cxxvi + 536, 660, 637. ill. Leipzig 1904. (*Recd.* 14/12/04.)

Gay-Lussac, Louis Joseph. Untersuchungen über das Jod. (1814). Herausgegeben von Wilhelm Ostwald. (Ostwald's *Klassiker*, No. 4.) Leipzig 1889. (*Recd.* 29/12/04.)

Kayser, H. Handbuch der Spectroscopie. 2 Bände. pp. xxiv + 781, xi + 696. ill. Leipzig 1900—1902. (*Recd.* 21/12/04.)

At the next Ordinary Meeting, on **Thursday**, February **2nd**, 1905, at **8** p.m., the following paper will be communicated:—

"Studies in the camphane series. Part XVI. Camphorylcarbimide and isomeric camphorylcarbamides." By M. O. Forster and H. E. Fierz.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 10/2/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 289.

Wednesday, January 25th, 1905. Extra meeting. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Professor W. H. PERKIN, F.R.S., delivered the Wislicenus Memorial Lecture.

Professor PERCY FRANKLAND, in proposing a vote of thanks, said:

"As a pupil of the late Professor Wislicenus, it has afforded me the greatest pleasure to listen to the admirable discourse of my friend Professor Perkin on the life-work of the great master to whom both he and I look back with reverence and affection, and to whom we both, and indeed all his pupils, of whom there are several others in the room to-night, owe so much and in such a variety of ways.

As one who, perhaps more than any of his other English students, enjoyed the privilege of his personal friendship and confidence, connected as I was with him by family ties, I may perhaps be permitted to add a few words with regard to Wislicenus as a man.

His work and reputation as an investigator will last as long as the present era of civilisation continues, for in the classical publications of which he is the author he has built up for himself a monument more enduring than brass or marble; but there is risk that the knowledge of many of the rare gifts with which he was so liberally endowed may pass away with the generation that knew him. The commanding

presence and those regular features, which might have well served Phidias or Praxiteles as a model for the Olympian Zeus, can, and will, be handed down in the portraits of him which are extant, but not so that magnetic oratory which clothed with romantic charm even the driest details of our science, nor the sympathetic flash of his penetrating eye and the kindly geniality of his smile, for these are things which can live only in the memories of those who had the privilege of his acquaintance in the flesh.

All through life Wislicenus was destined to be a leader of men. Already at school, as you have heard, he excelled all other boys in physical exercises—in swimming and gymnastics, in natural science, and especially in his command of the German language. When trouble came upon his father's house, you have heard how the conduct of his family into exile in America devolved upon him, although he was but eighteen years of age at the time. On the way to America, when cholera broke out on the ship, we find him taking charge of the steerage passengers stricken with the disease, and who had been abandoned by the doctor, not because the latter was overwhelmed with the necessities of the saloon passengers, as charitably asserted by Professor Perkin, but in reality because the doctor was devoting his attention to the whisky bottle in his own cabin. Arrived in America we find him supporting the family out of his slender earnings when he was still in his apprenticeship. On his return to Europe we find him rapidly promoted to the highest position in the academic world of Switzerland. At Würzburg he twice occupied the honourable position of Rector Magnificus of the University, and on the second occasion he was specially selected as, of all the professors, obviously the one most fitted to preside over the festivities connected with the tercentenary Jubilee of the University. On his transference to Leipzig we find him again soon filling the office of Rector of that University.

But it was not only in academic matters that he was marked out for leadership and distinction, for in any emergency, whether in private or public life, his friends and colleagues turned to him for support and counsel. This is well illustrated by an incident which occurred in Zürich at the close of the Franco-German war. The German inhabitants were celebrating the declaration of peace by means of a 'Commers' in the Tonhalle, and had thereby so excited the hostility of the Swiss, who were violently pro-French in their sympathies, that an angry crowd gathered outside, commenced throwing stones, and ultimately, I regret to say at the instigation of an English student, set fire to the building. The situation inside had now become very serious, the staircase was in flames and no water was procurable. Under these circumstances Wislicenus, who was presiding over the assembly, con-

ceived the idea as original as it was effective of having a cask of beer brought up from the cellar, and, after placing it in a suitable position, ordered it to be broken to pieces, with the result that the escaping beer extinguished the fire. When the company then left the building with Wislicenus at their head, his majestic figure, suggestive of a mediæval knight '*sans peur et sans reproche*,' silenced the hooting multitude, which until his appearance in their midst had been quite prepared to stone the Germans, and even to burn them alive.

In politics Wislicenus was also a great power, especially in the later years of his life. He was one of the founders of the 'Alldeutscher Verband' or Pan-Germanic Confederation, and he was the originator of the idea of greatly increasing the strength of the German Navy.

If I am not trespassing too much on your time I should like to relate a story told me by Wislicenus about one of his experiences in America, and which throws an interesting light on the state of professional chemistry in that country during the 'fifties of the last century. One day he was visited in his laboratory by two American gentlemen, who requested him to analyse and report on a sample of water from a mineral spring which they wished to boom for its therapeutic properties. They said they must have the analysis and report by the afternoon of the same day. This, Wislicenus said, was quite impossible, as the analysis would certainly take several days, and possibly even longer. The gentlemen replied that they were of course prepared to pay him double the usual fee, provided that the results of analysis were in their hands by the afternoon. Their surprise was unbounded when he still remained obdurate, and, saying that they guessed he must be a young greenhorn, they went to another chemist of high repute in the city, who duly furnished them with an elaborate analysis and report on the same day. This chemist afterwards cynically told Wislicenus that he had, to meet the exigency of the case, devised a method of analysing water by smell! In this atmosphere, Wislicenus began to feel exercised as to his moral security, or, to use his own words, '*ich fühlte mich dort nicht gewahr*,' and resolved to return to Europe at the earliest possible opportunity.

But Wislicenus exhibited the same high principle in all his dealings, and carried his lofty idealism and undivided devotion to duty into the smallest details of life, and these aspirations he had the power of communicating to those with whom he came in contact. Without any touch of Puritanism in the ordinary sense of the word, for he was full of good-fellowship and the friend of conviviality, he was one of those men who purify all their surroundings. In his presence it was impossible for anyone to harbour a mean or unworthy thought; his searching but optimistic gaze irresistibly drew forth the good and cast out the evil. It was also by means of this unquenchable optimism,

let us call it Faith, *der unerschütterliche Glaube*, that he was able to bear with such marvellous fortitude and resignation the terrible domestic afflictions with which his home was repeatedly visited, and which were calculated to embitter or even drive to despair any weaker nature, but which served to impress the spectator of Wislicenus's troubles with awe and reverence for the absolute fearlessness and self-command of the man. Indeed, I have always felt that to him might well be applied the lines of Horace descriptive of the unswerving heroism of the stoic:

> 'Si fractus illabatur orbis;
> Impavidum ferient ruinæ.'"

Professor ARMSTRONG seconded the motion, which was supported by Dr. L. T. THORNE, who said:

"As another old pupil of Professor Wislicenus, I wish warmly to support the vote of thanks proposed to Professor Perkin for the admirable memorial lecture he has just given, and also to add my own word of homage and gratitude to the memory of our old and loved master. I had the privilege not only of being one of Wislicenus's pupils, but also of being for some time his lecture assistant, and, as such, of living under the same roof with him, and therefore of seeing much of his family life. I can fully confirm the vivid picture of the strong, noble, and kindly nature of the man which has been given by the lecturer. Wislicenus knew, and was interested in, the work of all his students, even the most elementary. To his advanced students engaged in research work he was not only the teacher, but also the friend and fellow-worker in his beloved science, and his own love for and enthusiasm in chemical research roused a similar feeling in his pupils. At the meetings of the Würzburg Chemical Society, which he founded, he was not so much the master as the fellow-student, and these meetings were most helpful, and are still a pleasant memory with all old pupils.

All will read with the greatest interest the review of Wislicenus's work given by the lecturer, work which has been of such value to chemistry in general, and to the question of the atomic configuration in space in particular. Although, as Professor Perkin has said, not many papers dealing directly with this latter subject appeared during Wislicenus's professorship at Würzburg, I can testify that the interest in this question largely underlay the work of Wislicenus and his pupils during that period. Much of the work on the derivatives of ethyl acetoacetate was undertaken in the hope that, by modifying the conditions of replacement, substances showing optical activity might be artificially built up, and thus help

to prove the asymmetrical theory; and although negative results always ensued, Wislicenus's interest in the question did not diminish.

Personally I have always felt that Wislicenus's strong personality and friendly and even fatherly interest had a great influence on my life, an influence which I acknowledge with gratitude, and I believe the same feeling is entertained by all other old pupils. Wislicenus's life and work has undoubtedly done much for the good of chemistry."

The vote of thanks to the lecturer was then carried unanimously.

Thursday, February 2nd, 1905. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Messrs. Percy E. Spielmann and Alfred F. Joseph were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Bernard Scott Evans, B.Sc., 81, Babington Road, Streatham, S.W.
John Greig Ferrier, 2, Dalhousie Place, Arbroath, N.B.
Archibald Melville Glass, B.Sc., 73, Roderick Road, Hampstead, N.W.
Samuel Ernest Groves, 10, Melrose Avenue, Monkseaton.
Peter Maguire, Hamer House, Rochdale, Lancs.
Ernest Robert Marle, B.Sc., 135, Le Marchant Road, St. John's, Newfoundland.
Charles Stuart Shepherd, Worth Matravers Vicarage, Wareham.
William Ewart Speight, Corporation Sewage Works, Deighton, Huddersfield.
Arthur Walsh Titherley, D.Sc., Ph.D., Southcot, Moreton, near Birkenhead.

Of the following papers, those marked * were read:—

***12. "Camphorylcarbimide." By Martin Onslow Forster and Hans Eduard Fierz.**

Camphorylcarbimide, $C_8H_{14}<\begin{matrix}CH\cdot N:C:O\\CO\end{matrix}$, melting at 77°, is readily volatile in steam, and the vapour has a stupefying odour; it is quickly changed by water to *dicamphorylcarbamide*, $CO(NH\cdot C_{10}H_{15}O)_2$, which

melts at 261° and, with organic bases, yields symmetrical disubstituted carbamides, for example, *camphorylpiperidylcarbamide*,

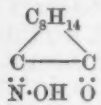
$$CO(NC_5H_{10})\cdot NH\cdot C_{10}H_{15}O,$$

and *camphorylbornylcarbamide*, $CO(NH\cdot C_{10}H_{17})\cdot NH\cdot C_{10}H_{15}O$, which melt at 186° and 305° respectively.

In addition to Rupe's camphorylcarbamide, from which camphorylcarbimide is obtained by the action of nitrous acid, aminocamphor hydrochloride and potassium cyanate yield *camphoryl-ψ-carbamide*, $C_{11}H_{18}O_2N_2$, which melts and decomposes at 188°; the *nitroso*-derivative, $C_{11}H_{17}O_3N_3$, which is not obtainable from the normal compound, melts at 158°, and, when freshly prepared, yields camphorylcarbimide with boiling water, losing this property in the desiccator. *Camphoryl-methyl-ψ-carbamide*, $C_{12}H_{22}O_2N_2$, the corresponding substance from methylaminocamphor, melts and decomposes at 200°; it is indifferent towards nitrous acid, and develops an intense, malachite-green colour with concentrated sulphuric acid.

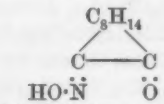
***13. "Configuration of *iso*nitrosocamphor and its unstable modification." By Martin Onslow Forster.**

It now seems possible to represent *iso*nitrosocamphor and its unstable form by the configurations



syn-Modification; m.p. 152°.

and



anti-Modification; m.p. 114°.

respectively. The evidence which, taken in conjunction with previous observations, has led to this conclusion arises from the behaviour of the isomerides towards magnesium methyl iodide. Of the four *oximes*, $C_8H_{14}<\begin{matrix}C{:}NOH\\ C(OH)\cdot CH_3\end{matrix}$, theoretically obtainable, three have been isolated and melt at 178°, 183°, and 187° respectively; these compounds are amphoteric, and solutions of all three in dilute sulphuric acid yield the liquid *anhydride*, $C_{11}H_{17}ON$, when warmed. Only two are transformed in warm alkali, however, the α-oxime (m. p. 178°) resisting this treatment; as the α-oxime is derived from the unstable *iso*nitrosocamphor (m. p. 114°), the latter appears to have the *anti*-configuration.

This conclusion receives support from the behaviour of the colourless benzoyl derivative and the *O*-methyl ether of *iso*nitrosocamphor, which are now represented by the formulæ

$$C_8H_{14}<\begin{matrix}C=N\\ C(OBz)\end{matrix}>O \qquad \text{and} \qquad C_8H_{14}<\begin{matrix}C=N\\ C(OMe)\end{matrix}>O$$

respectively. This type of structure explains the production of α-camphornitrilic acid on hydrolysis and the conversion into α-aminocamphor on reduction; moreover, magnesium methyl iodide transforms the above compounds into dimethylaminocamphor, the yield of which is quantitative in the case of the colourless benzoyl derivative.

***14. "The determination of molecular weight by lowering of vapour-pressure." By Edgar Philip Perman.**

The author has worked out the details of a simple method by which molecular weights can be determined with moderate accuracy from measurements of the lowering of vapour-pressure of the solvent in which the substance under investigation is dissolved. The solution is heated in the vapour of the pure solvent, boiling under atmospheric pressure, and the lowering of vapour-pressure is read directly. It is, however, necessary to pay great attention to the manipulation.

Discussion.

Dr. Barger pointed out that, although the freezing point and the boiling point methods might be considered preferable for ordinary purposes, the value of vapour pressure methods lay in the possibility of applying them to special cases where other methods failed. This was found to be the case with the microscopical vapour pressure method described by him a year ago.

Mr. Baly pointed out that in all probability the determination of molecular weights by the vapour pressure of a solution would be vitiated owing to a difference in the concentration in the surface layer, more than would be the case in observing the boiling point of the solution. In the latter method, a very rapid renewal of surface was taking place, whilst in the former, one is dependent more or less upon a constant surface. He asked whether the author had taken care to shake his apparatus, since differences of concentration in the surface are known to occur, as, for example, in solutions of butyl alcohol.

Mr. Arthur Marshall said he could corroborate the statements made as to the practicability of ascertaining molecular weights by means of vapour pressure measurements. He described a simple apparatus he had used in determining the vapour tension of binary liquids, in which the difficulty of obtaining a liquid in a uniform condition was overcome by employing a small glass rod placed in such a manner that when the apparatus was shaken the rod stirred the liquid. But even with this precaution he had found that in order to obtain a state of equilibrium it was necessary to allow the apparatus to remain at constant temperature for several hours with occasional shaking.

15. "Note on β-NH-ethenyldiaminonaphthalene." By Raphael Meldola and Joseph Henry Lane.

The ethenyldiaminonaphthalene, obtained by Prager in 1885 by debrominating the bromoanhydro-base prepared by the reduction of 4-bromo-2-nitroaceto-α-naphthalide (*Ber.*, 1885, **18**, 2161), has been assumed in our former paper (*Trans.*, 1904, **85**, 1594, footnote) to be identical with the anhydro-base obtained from Markfeldt's ethenyltriaminonaphthalene by the diazo-method. We have already pointed out (*loc. cit.*) that no direct proof of this identity has hitherto been given, and we have accordingly repeated Prager's experiments with certain modifications, which throw further light on the general nature of the isomerism which has formed the subject of our investigations. The bromonitroaceto-α-naphthalide was reduced with iron and hydrochloric acid instead of with stannous chloride, as in Prager's method, and the bromoanhydro-base was found to be identical with that obtained by the author named. This result is of importance as supporting the hypothesis that the isomerism of the ethenyltriaminonaphthalenes is due to the simultaneous or successive reduction of the nitro-group (*loc. cit.*, p. 1595). When the 4-position is occupied by a bromine atom instead of by a nitro-group, the nature of the reducing agent makes no difference in the nature of the bromoamidine. Iron and tin both give the same product. The latter was debrominated by boiling for 2 days in alcoholic solution with zinc dust and alkali, and the amidine thus obtained was found to be identical in every respect (m. p. of picrate, &c.) with Prager's base. The latter is therefore now conclusively shown to be the β-NH-amidine, as formerly assumed, the transference of the NH-group from the α- to the β-position taking place simultaneously with the removal of the bromine atom in the manner indicated in our last paper (*loc. cit.*, p. 1594).

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Darapsky, L. Enteisenung von Grundwasser. pp. 104. ill. Leipzig 1905. (*Recd.* 23/1/05.) From the Author.

Goppelsroeder, Friedrich. Studien über die Anwendung der Capillaranalyse. pp. 198. ill. Basel 1904. (*Recd.* 23/1/05.) From the Author.

Lassar-Cohn. Chemistry in daily life. Popular lectures. Translated by M. M. Pattison Muir. pp. xii + 340. ill. London 1905. (*Recd.* 18/1/05.) From the Translator.

Lunge, G. Techno-chemical analysis. Authorised translation by Alfred I. Cohn. pp. 136. ill. New York 1905. (*Recd.* 24/1/05.) From the Publishers.

Nobel. Les prix Nobel en 1901. pp. 112. ill. Stockholm 1904. (*Recd.* 14/1/05.) From the Royal Academy of Sciences, Sweden.

II. *By Purchase.*

Claassen, H., und Bartz, W. Die Zuckerfabrikation. pp. x + 270. ill. Leipzig 1905. (*Recd.* 1/2/05.)

Nernst, Walter. Theoretical chemistry from the standpoint of Avogadro's rule and thermodynamics. (Translated by Robert A. Lehfeldt.) Revised in accordance with the fourth German edition. pp. xxiv + 771. ill. 1904. (*Recd.* 18/1/05.)

III. *Pamphlets.*

Alwood, William B., Davidson, R. J., and Moncure, W. A. P. The chemical composition of apples and cider. (U. S. Dept. of Agric., Bureau of Chemistry, Bulletin No. 88.) Washington 1904.

Clayton, Edwy G. The will of Sir William Browne, M.D. (1692—1774). (From the *British Medical Journal*, 1904.)

Lamb, M. Charles. The detection of adulterants in sumach by microscopical examination. (From the *J. Soc. of Dyers and Colourists*, 20, 1904.)

—— The dyeing of chrome leather, and storing in the "crust." (From the *J. Soc. of Dyers and Colourists*, 20, 1904.)

—— "Seaweed as a finishing material for leather." (From the *Leather Trades Review*, 1904.)

—— The determination of sulphuric acid in leather. pp. 7. London 1903.

ANNIVERSARY DINNER.

It has been decided by the Council to arrange for a Dinner of the Fellows of the Society and their friends on **Wednesday, March 29th, 1905,** this being the day fixed for the Annual General Meeting. Further particulars will be announced shortly.

At the next Ordinary Meeting, on **Wednesday,** February **15th,** 1905, at **5.30** p.m., the following papers will be communicated:

"The condensation of phenylglycine esters in presence of sodium ethoxide." By A. T. de Mouilpied.

"Nitrogen halogen derivatives of the aliphatic diamines." By F. D. Chattaway.

"Nitration of substituted azo-phenols." By J. T. Hewitt and H. V. Mitchell.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Wednesday, February 15th, 1905.

Angel, Andrea,

41, Wellington Square, Oxford.

M.A. Chemistry Tutor to the Non-Collegiate Students, Oxford University. Late Exhibitioner, and Dixon Scholar of Christ Church, Oxford. First Class Honours (Chemistry) in the Final School of Natural Science, 1899. Joint Author, with Mr. Vernon Harcourt, of "Observations on the Phenomena and Products of the Decomposition of Normal Cupric Acetate when Heated," *J. C. S.* (Trans.), 1902, p. 737. Engaged upon a similar investigation of Cupric Formate.

A. Vernon Harcourt. D. H. Nagel.
H. Brereton Baker. W. W. Fisher.
J. E. Marsh.

Arnaud, Francis William Fredk.,

17, Maddox Street, London, W.

Analytical Chemist. Studied Chemistry, etc., at King's College, London. For about ten years have been engaged in Analytical Chemistry, and at present Assistant to C. H. Cribb, Esq., F.I.C. I am an Associate of the Institute of Chemistry.

W. F. Lowe. Cecil H. Cribb.
A. J. Greenaway. J. H. Coste.
R. Grimwood. Frank Clowes.
J. M. Thomson. *E. T. Shelbourn.*

Ashwell, James Henry,

117, Waterloo Crescent, Nottingham.

Bleacher and Dyer of Hosiery. Manager of H. Ashwell & Co., Hosiery Finishers. Attended the Chemical Course at Owens College. Member of the Society of Chemical Industry; also of the Faraday Society.

Francis D. Toyne.	*A. B. Steven.*
Reginald B. Brown.	*A. G. Perkin.*
Arthur Slator.	*Henry J. S. Sand.*

Barnes, James Hector,

The Briars, King's Norton, Birmingham.

Analytical Chemist and Assistant to C. C. Duncan, Esq., County Analyst for Worcestershire. Bachelor of Science of the University of Birmingham. Five years Assistant to the late Mr. John Barclay, B.Sc., F.C.S., Analytical Chemist.

Percy F. Frankland.	Alex. Findlay.
Alex. McKenzie.	T. S. Moore.

T. Slater Price.

Briggs, Samuel Henry Clifford,

Green Bank, Cleckheaton, Yorks.

Worsted Spinner. Student for six years in the University of Leeds. 1st Class Honours in Chemistry in Victoria University B.Sc. exam., 1901. Joint author of following papers: *Trans.*, 1902, 210 (with A. G. Perkin, Esq.); *Proc.*, 1902, **18**, 172, and *Trans.*, 1903, **83**, 1213 (with Prof. J. B. Cohen); Author of following papers: *Trans.*, 1903, **83**, 391; *Trans.*, 1904, **85**, 672 and 677.

Arthur Smithells.	J. B. Cohen.
A. G. Perkin.	H. M. Dawson.

C. E. Whiteley.

Campbell, James H.,

3, Morrison Terrace, North Road, Bellshill, N.B.

Metallurgical Chemist. For seven years at the Works of the Landore Siemens Steel Co., and for eighteen years chief chemist of the Summerlee and Mossend Iron and Steel Co., Mossend, N.B. At present partner of the firm of Robertson and Campbell, Analytical and Consulting Chemists, Glasgow.

Frederick Robertson.	Thomas Gray.
Douglas A. MacCallum.	*G. G. Henderson.*

A. Humboldt Sexton.

Clark, F. E.,

Instructor in Chemistry in the Pennsylvania State College, State College, Pa.

Bachelor of Science, West Virginia University, 1898; Doctor of Philosophy, Johns Hopkins University, 1902. Subject of dissertation: "The Action of Substituted Ammonias of the Aliphatic Series on the Chlorides of *ortho*-Sulphobenzoic Acid" (*American Chemical Journal*, vol. 30, p. 277).

Jas. Lewis Howe. — Ira Remsen.
G. G. Pond. — *F. P. Venable.*
J. F. McGregory.

Clarkson, George Douglas,

Mirfield, Yorkshire.

Analytical Chemist, as applied to Brewing and Malting. For ten years Assistant to Lawrence Briant in general Analytical work and demonstrator in Brewing Chemistry, and five years Analyst to large firm of Maltsters in Yorkshire (present berth).

Alex. K. Miller. — Lawrence Briant.
Tom Crossman. — Arthur J. Starey.
Harold W. Harman.

Collitt, Bernard,

79, Eastbourne Terrace, Gainsborough.

Analytical Chemist to Messrs. Marshall, Sons & Co., Ltd., Engineers, Gainsborough. 1901, Jacob Bell Scholar at the School of Pharmacy; 1902, Passed the Minor Examination; 1903, Passed as Pharmaceutical Chemist and obtained Silver Medal for Chemistry (Advanced), and Certificate for distinguished merit in Botany (Advanced) (of the Pharmaceutical Society of Great Britain). Studied one term in Metallurgical Laboratory of Sheffield University College (Technical Department) under Prof. J. O. Arnold. Spent one year as assistant chemist in the Analytical Laboratory of Messrs. Ludw. Loewe & Co., A.G. Berlin, Germany.

J. Norman Collie. — *Arthur W. Crossley.*
W. Palmer Wynne. — *Harry Lucas.*
T. E. Wallis. — *F. Filmer De Morgan.*
E. J. Millard. — *F. M. Mercer.*

Eade, Samuel George,

10, Eagle Street, Port Talbot, S. Wales.

Science Master in Port Talbot County School. I have studied Chemistry at Wellingboro' Gram. Sch., University Tutorial Coll., London, Municipal Tech. Sch., Birmingham, and have taught the

subject at Loughton School, Essex, and at Port Talbot County School. I have passed the following exams. in Chemistry: Inter. Science and Prelim. Scientific London University. Board of Education, Stage III., Theoretical and Practical (Inorganic).

W. H. Edwards. *J. W. Shepherd.*
Joseph Brown. *Wm. Ping.*
George H. West. *W. A. Rugginz.*

Gardner, Charles Richard,
Green Cottage, Brunswick Sq., Gloucester.

Chief Assistant to Mr. G. Embrey, F.C.S. Student at Gloucester School of Science from 1890 to 1895. As second Assistant to Mr. G. Embrey, F.C.S., F.I.C., Analyst for the County of Gloucester, from 1892 to 1897, and from then until present date as Chief Assistant.

George Embrey. J. S. S. Brame.
J. Kear Colwell. Raymond Ross.
Will. T. Boone.

Goodier, Herbert,
16, Hall Royd, Shipley, nr. Bradford.

Experimental Engineer, c/o The Bradford Dyers' Association, Bradford. Experimental Engineer, dealing with new processes, etc., in Dyeing, etc. Holder of 3 years' Scholarship (Evening) in Chemistry and Dyeing, Bradford Technical College. I wish to keep in touch, mainly, with Chemical Literature as applied to Bleaching, Dyeing, Finishing, and Calico-printing.

Thorp Whitaker. John K. S. Dixon.
Walter Leach. A. B. Knaggs.
Ellis Clayton.

Heely, Frederick William,
10, Yarborough Street, Grimsby.

Engaged in the analytical work in connection with the Pharmacy of W. Barker, Esq., 81, Victor Street, Grimsby. Passed the Minor and Major Examinations of the Pharmaceutical Society, was for one year a student at the Metropolitan College of Pharmacy, Kennington Park, S.E., and now desirous of having the Society's Publications to keep in touch with modern analytical processes.

W. Watson Will. David J. Williams.
F. Filmer De Morgan. *Edward Divers.*
H. Lucas. *Peter MacEwan.*
Thos. Tyrer.

Henderson, James Alexander Russell,

Chihli Provincial College, Paotingfu, N. China.

Professor of Chemistry and Physics. B.Sc. Glasgow University (Ap. 1901): Research with Dr. W. Carrick Anderson on Indian and Japanese Coals: and action of pyridine on coals: published *Jour. Soc. Chem. Ind.*, Feb. 28th, 1902: laboratory assistant and demonstrator to lecturer in Organic Chemistry in Glasgow University, 1899—1901: 3½ years full charge of works laboratory of Messrs. Glenfield & Kennedy, Ltd., Hydraulic Engineers, Kilmarnock. Research on cast-iron and various alloys, especially manganese bronzes. Appointed Prof. of Chemistry.

W. Carrick Anderson. Thomas Gray.
John Ferguson. G. G. Henderson.
James Roberts, jun. *A. Humboldt Sexton.*

Hennings, Dr. Carl Richard,

19, St. Dunstan Hill, London, E.C.

Analytical Chemist. Farbenfabriken vorm. Friedr. Bayer & Co., Elberfeld. German State Examination as Pharmaceutical Chemist, Freiburg i/B. 1899. Ph.D. in Natural Sciences, Freiburg i/B. 1901. German State Examination in Food Chemistry, Berlin, 1902. Contributions: Ber. d. D. Ch. Ges., XXXIV., 1772—1778; XXXV., 1338—1400.

C. Duisberg. Wyndham R. Dunstan.
James Dewar. Thos. A. Henry.
Edgar J. Millard.

Jones, Bernard Mount,

"Alcala," Hermitage Road, Upper Norwood, S.E.

Student of Chemistry, engaged in research work. Natural Science Scholar of Balliol College, Oxford. First Classes in Honours in the Final Schools of Chemistry, Mineralogy, and Crystallography.

H. Brereton Baker. Harold Hartley.
Henry A. Miers. D. H. Nagel.
R. Tabor Lattey.

Jones, Percy Walter,

Toowong, Brisbane, Queensland.

Assistant Government Analyst. Five years Assistant Government Analyst, Queensland. Four years Lecturer in Chemistry for the Pharmaceutical Society and Sydney University Extension Board of Queensland. One year Assistant to Government Analyst, South

Australia. Four years Junior Assistant to Dr. Rennie, Professor of Chemistry, Adelaide University.

J. Brownlie Henderson. W. A. Hargreaves.
J. C. Brünnich. Edward H. Rennie.
Alexander Orr.

Jones, Tudor Foulkes,

Bro Dawel, Bangor, North Wales.

Mathematical and Science Master at Lurgan College, Co. Armagh, Ireland. B.Sc. (Wales). Final Subjects:—Mathematics (Pure and Applied) and Chemistry (Inorganic and Organic); also Intermediate Physics. My training in chemistry extended over 4 years, 1898—1902, and on an average I put in 10 hours a week. I studied at the University College of North Wales, Bangor. Since August, 1902, I have been engaged here as Mathematical and Science Master, the science subjects including Elementary Physics and Elementary and Advanced Chemistry.

James J. Dobbie. J. Holms Pollok.
Alexander Lauder. E. A. Letts.
Robt. D. Abell.

Leech, Herbert Louis,

3, London Road, Blackburn.

Demonstrator in Chemistry at the Technical School, Blackburn. I have studied Chemistry for upwards of six years; for two sessions at the Municipal Technical School, Manchester, at the Victoria University for one year, and have had four years' practical experience in the chemical works of Levinstein's, Ltd., of Crumpsall. I have recently been appointed as assistant to Dr. Pickard and Demonstrator in Chemistry at the Technical School, Blackburn.

Robert H. Pickard. Stanley J. Peachey.
William J. Pope. Frank S. Sinnatt.
L. G. Radcliffe. *Jas. Grant.*

Lister, Joseph,

50, Portland Street, Lancaster.

Science Master. (1) B.Sc., London, with Honours in Chemistry; (2) A.R.C.S., Lond.; "Hatton" prizeman in Chemistry; (3) Lecturer on Chemistry, Leeds Central Higher Grade School, for 5 years. (4) Senior Science Master, Storey Institute, Lancaster, for 1½ years.

William A. Tilden. G. T. Morgan.
M. O. Forster. Chapman Jones.
James C. Philip.

Lloyd, George Moss, M.A., M.Sc.,

"Homeland," Queen's Road, Rock Ferry, Cheshire.

Schoolmaster in employ of Liverpool Education Authority, also a post-graduate student in Chemistry, a Master of Science of the University of Liverpool (degree was taken in 1904 in the Honours School of Chemistry). At present a post-graduate student at the University of Liverpool, doing Chemical Research. Also M.A. (Vict.) and Inter. B.A. (London).

J. Campbell Brown. Sydney Young.
F. G. Donnan. H. B. Dixon.

A. C. Abraham.

Lucas, Edward William, F.I.C.,

37, Barton St., Kensington, W.

Wholesale Chemist and Druggist, late Assistant Government Analyst, Hong Kong. Fellow of the Institute of Chemistry. *Author* of "Practical Pharmacy," pp. 528, "Churchill." Editor of "Beasley's Book of Prescriptions," 1905, Edition "Churchill," and numerous papers on Analytical and Pharmaceutical Chemistry in the Pharm. Journal and other Journals. One of the Referees in Pharmacy in connection with the Revision of the British Pharmacopœia.

W. Palmer Wynne. F. Stanley Kipping.
W. H. Perkin, jun. Percy F. Frankland.

Walter Hills.

Luck, Alfred Courtenay,

Crosslea House, Ipswich.

Explosives Manufacturer, now Chief of the Experimental and Chemical Department for Explosives, Argentina Government. Four years as Assistant to W. E. Halse (late F.C.S., F.I.C.), many years chief chemist to Pigou Mills & Laurence, Ltd., Dartford. Joint author with C. F. Cross of a paper on Nitro-cellulose, read before Chemical Industry Society.

C. F. Cross. Henry de Mosenthal.
Edward Bevan. Oscar Guttmann.

Geo. W. MacDonald.

Meldrum, Andrew Norman,

16, Mooroaks Road, Sheffield.

Lecturer and Demonstrator in Chemistry, University College, Sheffield. Associate of the Royal College of Science, London (1896), Doctor of Science, Aberdeen (1904). Studied Chemistry at Aberdeen University, the Royal College of Science, London, and University

College, Dundee. Lecturer and Demonstrator in Chemistry at University College, Liverpool (1900—2), and Aberdeen University (1902—4). Joint author with Professor Japp of four papers published in the Transactions of the Chemical Society.

F. R. Japp.	W. Palmer Wynne.
James Walker.	W. E. S. Turner.
John S. Lumsden.	M. O. Forster.

Mills, William Sloan, M.A.,
Queen's College, Galway.

Kodak Company's Research Assistant (since 1903), working at Queen's College, Galway. Student and Scholar, Q.C.G., 1894—1900; Dem. of Chem., 1897—1900; B.A. in Chem. and Physics, Hon. and £21 Exhib., 1898; M. A. Honors, 1900; published paper:—"Diphenyl and Dialphyl Ethylene Diamines," etc. (Trans. Chem. Soc., 1900, **77**, 1020); 1851 Exhib. Research Scholar working at Berlin Univ., 1900—1901, 1901—1902 and, for third year, 1902—1903. Other published papers on Glucoside Synthesis and on the Action of Oxides of Nitrogen on Oximido-compounds:—J. Chem. Soc., 1901, Trans., **79**, 704; Scient. Proc. Roy. Dub. Soc., 1901, **9**, 506 and 508; Brit. Assoc. Report, 1903, 635, 636, and 637; Liebig's Annalen, 1904, **330**, 247.

A. Senier.	Alex. McKenzie.
W. Goodwin.	R. H. Aders Plimmer.
E. Frankland Armstrong.	M. O. Forster.

Moore, Charles Watson, B.Sc.,
38, Demesne Road, Whalley Range, Manchester.

Student of Chemistry. Five years a Chemist with Messrs. I. Levinstein & Co., Ltd., and subsequently studied for 4 years at the Owens College. Graduated B.Sc., Victoria University, with First Class Honours in Chemistry in 1904. Author of "The Formation of Phloroglucinol by the Interaction of Ethyl Malonate with its Sodium Derivative" (*Trans.*, 1904, **85**, 165).

H. B. Dixon.	G. H. Bailey.
W. H. Perkin, jun.	William A. Bone.
D. L. Chapman.	J. F. Thorpe.

Pennycuick, Thomas, B.Sc., Lond.,
6, Lorne Street, Fairfield, Liverpool.

Science Master, Green Lane School, Liverpool. B.Sc., London. Assistant Chemistry Master, St. Mark's Upper School, Chelsea

[1895—1898]. First Assistant (Science Master), Green Lane School, Liverpool.

Frank E. Weston.	J. C. Crocker.
Henry R. Ellis.	*Edward Haworth.*
J. Bernard Coleman.	*H. Baker.*

Perrott, Bert,

Ael-y-Bryn, Penywern Road, Neath, Glam.

Science Master and Lecturer in Chemistry. As a student I have made a special study of Chemistry for the last 8 or 9 years, having studied at several of the recognised London Institutions, but more especially under Prof. Hewitt at the East London Tech. College. The last 4½ years have been spent in teaching the subject, formerly at the Ilford Higher Grade School and now at the Neath Intermediate and Technical School.

William Ping.	J. T. Hewitt.
W. A. Rugginz.	Thomas L. D. Porter.

J. A. Harrison.

Pyman, Frank Lee,

The Oaks, Hitchin, Herts.

Chemist. 1902, B.Sc. degree (1st Class Chemistry Honours), Owens College, Manchester. Leblanc Medallist, Mercer Scholar, 1904, Ph.D. degree (Basle). Publications: Berichte d. Ch. G., 36, 2700. Bamberger and Pyman, "Ueber *o*-Hydroxylaminobenzoesäureäthylester." Dissertation (Zurich, 1904), "Ueber *o*-Hydroxylaminobenzoesäure und Oxy-ψ-anthranil."

Harold B. Dixon.	William A. Bone.
W. H. Perkin, jun.	Frederick B. Power.

Frederic H. Lees.

Quant, Ernest,

2, Park Crescent, Torquay.

Analytical and Consulting Chemist, Director of South Devon Chemical and Bacteriological Laboratory. Analyst for last nine years to Devonshire Dairies, Limited, Torquay, and 409, Oxford Street, London. Member of the Pharmaceutical Society. Studied Chemistry (General), School of Science, Gloucester. Pharmaceutical: South London (Muter's) School of Pharmacy. Food Analysis (special courses), Public Analysts' Laboratory, Exeter, and King's College, London.

John Muter.	Patrick H. Kirkaldy.
George Embrey.	Thomas Tickle.
John M. Thomson.	*A. H. M. Muter.*

Ratcliffe, William Henry,

18, Wheeler Street, Maidstone.

Teacher of Science. B.Sc. (London University). Teacher of Science, Tenison's School, Leicester Square, W.C. I am desirous of keeping in touch with the latest literature in Chemistry.

Frank E. Weston.	*Edward Haworth.*
H. R. Ellis.	*H. Baker.*
C. T. Bennett.	*Harold M. Read.*

Richards, Frederick George,

21, Dutton Street, Manchester.

Demonstrator in the Brewing Department, Municipal School of Technology, Manchester. Three years Student at the School of Technology, 1896 to 1899. Chemist at Oxynite Works, Newport (Mon.), 1899 to 1902. On the staff of the School of Technology from 1902. Honours in Inorganic Chemistry (Science and Art). First Honours and Silver Medallist in Brewing (City and Guilds).

William J. Pope.	F. S. Sinnatt.
Jas. Grant.	Arnold Turner.
L. G. Radcliffe.	Henry Gough.

Rogers, Harold Rudolph,

75, South Side, Clapham Common, London, S.W.

Science Master at the Croydon Borough Secondary School for Boys. (1) Honours, B.A., Oxford, second class in the Final Honour School of Natural Science, Chemical Section. (2) Honours Intermediate, B.Sc., London, in Chemistry. (3) Science tutor at St. Mark's College, Chelsea, S.W.

John Watts.	J. E. Marsh.
W. W. Fisher.	D. H. Nagel.

N. V. Sidgwick.

Scholefield, Fred,

9, Lyndhurst Villas, Magdalen Road, Norwich.

Analytical Chemist. 1900—1904 received scientific training at the Yorkshire College, Leeds, specialising in Chemistry. Obtained B.Sc. (Lond.), 1902; B.Sc. (Vic.), with First Class Honours in Chemistry, 1903; A.I.C., 1904. Joint author of paper in the Society's Journal (Trans., 1904, v. 85, p. 1432), "On the Colouring Matters of the Stilbene Group." At present Chemist to Messrs. F. Hinde & Sons, Ltd., St. Mary's Silk Mills, Norwich.

Arthur Smithells.	A. G. Green.
J. B. Cohen.	A. G. Perkin.

H. R. Procter.

Schröder, Harold,

Lithgow, N.S. Wales.

Assayer. Great Cobar Copper Mining Syndicate. Teacher of Assaying, Moonta School of Mines, S. Aus. Lecturer of Chemistry, Lithgow Technical College. Chief Assist. Chemist, Wallaroo Smelting Works, S. Aus. Chief Chemist and Assayer, G.C.C.M.Synd., Lithgow.

G. C. McMurtry. J. A. Schofield.
Edward H. Rennie. *G. A. Goyder.*

Basil Turner.

Scott, John Irwin,

Trent College, Long Eaton, Derbyshire.

Science Master. B.A. (Oxon.). First Class in Final Honours School of Natural Science (Chemistry). Eight months' work in the Erstes Chemisches Laboratorium, Leipzig, under the late Prof. J. Wislicenus.

V. H. Veley. J. E. Marsh.
W. W. Fisher. John Watts.

H. L. Bowman.

Seaton, William Dunham,

40, Argyle Road, Ilford, Essex.

Analytical Chemist, Messrs. Parke, Davis and Co., Manufacturing Chemists, Hounslow, Middlesex. Certificated Day Student (Third Year), Chemical Department, Technical College, Finsbury, Leonard Street, E.C. Late Student-Chemist, Messrs. John Brown and Co., Atlas Steel and Iron Works, Sheffield.

R. Meldola. F. Southerden.
John Castell-Evans. *Frank E. King.*

J. F. H. Gilbard.

Simmons, William Herbert,

"Oakleigh," Stoke Newington Common, London, N.

Analytical Chemist. B.Sc. (Lond.). Studied Chemistry at Finsbury Technical College and the Birkbeck Institute. For 3¼ yrs. Assistant to Dr. S. Rideal, F.I.C. For last 2 yrs., and at present, Chemist to the Vinolia Co., Ltd. Joint author with F. Hudson Cox, Esq., F.I.C., of a paper on "Otto of Rose" before the Society of Public Analysts, and contributor of notes on essential oils to the *Chemical News* and *Chemist and Druggist.*

Samuel Rideal. John E. Mackenzie.
William T. Burgess. J. W. Shepherd.

Lawrence Briant.

Troye, Gustave Arthur,

Johannesburg, P.O. Box 2706.

Consulting Engineer. Surveyor to late Transvaal Government, Compiler of Troye's Map of the Transvaal and other geographical compilations, consultant to Sundry Mining and Financial Companies. A Student of Chemistry, especially Mineral Chemistry, for many years. A member of the Institution of Mining and Metallurgy, London, where I read paper, 16th Jan., 1901.

John J. Beringer. H. W. Hutchin.
H. R. Beringer. *A. D. Hall.*

W. H. Merrett.

Want, William Phillip,

11, Pearfield Road, Forest Hill.

Editor, British and Colonial Druggist, 44, Bishopsgate Without, E.C. Pharmaceutical Chemist; Bell Scholar, Pharmaceutical Society, 1885—6. School of Pharmacy of the Pharm. Society: Chemistry and Chemical Physics, First certificate of merit, March, 1886, and First certificate of honour, July, 1886; Botany and materia medica, Bronze medal, March, 1886; First certificate of honour, July, 1886, Matriculation certificate of University of London; Senior Cambridge Local Exam. Honours (3rd class) with Distinction in English and Zoology. College of Preceptors, First Class, First Division, Special certificate in 6 subjects.

John Attfield. *Joseph W. Swan.*
Wyndham R. Dunstan. *Frederick B. Power.*
Thomas Tyrer. *H. A. D. Jowett.*

Weiskopf, Eric H.,

Modderfontein, Transvaal.

Chief Laboratory Chemist, and Technical Chemist, Dynamite Factory, Modderfontein, B.S.A. Explosives Co., Ltd. Read paper on "Missfires, their theory, etc.," before C.M.S. of S.A. (Journal, 1902—3), do. on "The Contact Process" before S.A. Assoc. for Adv. of Sc. (In course of publication, 1904). Gave evidence before Miners' Phthisis Commission on Toxicology and kind and amount of gases of explosives. (Transvaal, Blue Book on subject, 1903). Toxicology of Nitrous Oxides (Extract in Zeitschrift für angew. Chemie, No. IV., 1904), etc., etc.

G. H. Beckett. Leo F. Guttmann.
Oscar Guttmann. *G. G. Henderson.*

Thomas Gray.

Wheeler, Ernest,

335, Park Road, Oldham, Lancs.

Analytical and Metallurgical Chemist at Messrs. Crossley Bros., Ltd., "Otto" Gas Engine Works, Openshaw, Manchester. For three

years articled pupil with Messrs. Crace, Calvert, and Thomson, Royal Institution Laboratory, Manchester. Four and a half years with Messrs. Platt Bros. and Co., Ltd., Textile Manufacturers, Hartford Iron Works, Oldham, as Chief Chemist. For the last one and a half years (and at the present time) with Messrs. Crossley Bros., Ltd., Gas Engine and Gas Producer Manufacturers, as Chief Chemist.

William Thomson.	John Allan.
John Angell.	*J. Hübner.*
William J. Pope.	*J. Carter Bell.*
James Porter Shenton.	*F. S. Sinnatt.*

Wigginton, John Henry Becker,
Kennington Cross, S.E.

Analytical Chemist. General Manager of the Laboratories of Messrs. S. F. Goss, Ltd., Scientific Chemists, Wholesale and Export, 460, Oxford Street, and 201, Regent Street, London, W. Chief Chemist to the above Firm. Member of the Pharmaceutical Society of Great Britain. Certified Dispenser of the Society of Apothecaries of London. Enrolled Ophthalmic Optician, Brit. Optical Association.

A. H. M. Muter.	F. Pilkington Sargeant.
J. W. Epps.	*Chas. Turner.*

George H. Gabb.

Wilkinson, John Wells,
28, Egerton Terrace, Bexley Road, Northumberland Heath, Belvedere, Kent.

Teacher and Chemist. Associate, i. Merchant Venturers' Technical College, Bristol (chemistry), ii. University College of Wales, Aberystwyth. M.A. (Wales); Inter. B.Sc. (London); Honours Board of Education (Theoretical and Practical). Late Teacher of Chemistry, Science School, Fairfield Road, Bristol. Late Analytical Chemist, Messrs. Francis & Co., Ltd., Cement Manufacturers, Cliffe, Kent, and Vauxhall, London.

Ernest H. Cook.	J. Wertheimer.
Jas. H. Haynes.	*Tho. W. Wormell.*

G. P. Darnell-Smith.

Williams, Alan Herbert,
127, Roseneath Road, Urmston, Nr. Manchester.

Teacher in Science Department of Urmston Secondary School. I have passed the Intermediate B.Sc. examination in Chemistry of Univ. of Wales, and worked under Professor Thompson in Cardiff University

for two years, am now taking the honours course in Manchester Technical College, working under Professor Pope.

John Allan. S. J. Peachey.
W. J. Pope. *F. S. Sinnatt.*
L. G. Radcliffe.

The following Certificate was authorised for presentation to ballot by the Council under Bye-Law I. (3):

Chatterji, Hem Chandra,

Cawnpore, United Provinces of Agra and Oudh, India (East).

Professor of Physics and Chemistry, Christ Church College, Cawnpore (India). Passed the B.A. Exam. of the Allahabad University in Science Course. Attended lectures in Practical Science for the M.A. Examination for about a session. Lecturer in Ch. Ch. College for over eight years.

Gopal Ch. Banerjee. Abhayacharan Sanyal.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 28/2/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 290.

Extraordinary General Meeting, February 8th, 1905. Professor W. A. TILDEN, D.Sc., F.R.S, President, in the Chair.

Forty-five Fellows were present.

The following Bye-laws were submitted by the Council for the consideration of the Fellows.

BYE-LAWS.

I.—*Of the Election, Contributions, and Rights of Fellows.*

THE method of voting for the election of Fellows shall be by ballot.

Every Candidate for election into the Society as a Fellow thereof shall be proposed according to a form of certificate (see Appendix No. 1) subscribed by not less than five Fellows of the Society, to three, at least, of whom he is personally known; but in the case of a Candidate resident abroad the Council shall have the power to permit these requirements to be dispensed with if the certificate is signed by at least one Fellow of the Society to whom the Candidate is personally known. The name of each Candidate shall be read at three Ordinary Meetings, and his certificate shall be published in full in the Society's Proceedings and suspended in the Society's rooms or place of meeting until the Candidate has been duly balloted for.

Ballots shall take place at Ordinary Meetings, and those Candidates shall be balloted for whose certificates have been read at two previous Ordinary Meetings and again on the occasion of the ballot.

The election shall not be valid unless thirty-two or more Fellows vote; and until that number shall have voted the Candidate shall be balloted for at consecutive Meetings until thirty-two Fellows shall have voted on the question of the election of such Candidate. When three-fourths or more of the Fellows who vote are in favour of the Candidate, he shall be elected; but when less than three-fourths of the Fellows who vote are in favour of the Candidate, he shall not be elected. The result of the ballot shall be ascertained by two Scrutators and one of the Secretaries, and declared by the Chairman.

The person thus elected, previous to his admission, shall, within three months from the date of his election, pay an admission fee of Four Pounds, and in addition thereto his first annual subscription, or a life composition fee, otherwise his election shall be void; power to extend this period of three months being, however, reserved to the Council. He shall also return to the Secretaries the following Obligation, duly signed:—"I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the Chemical Society, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue a Fellow thereof."

The annual subscription to be paid by Fellows shall be Two Pounds; except that Fellows elected before the first day of January, 1860, who have hitherto paid One Pound only, shall continue to pay at that rate. The annual subscriptions of Fellows shall become due on the first day of January in every year.

If a person be elected during the month of November or December in any year he shall not pay any annual subscription for that year, but shall not be entitled to receive the publications of the Society for that year.

The life composition fee shall be Thirty Pounds, except that Fellows who have paid ten annual subscriptions shall pay as life composition fee Twenty Pounds; Fellows who have paid fifteen annual subscriptions shall pay Fifteen Pounds; Fellows who have paid twenty annual subscriptions shall pay Twelve Pounds; and Fellows who have paid twenty-five annual subscriptions shall pay Ten Pounds.

The admission of Fellows shall take place after the reading of the Minutes at Ordinary Meetings of the Society. After the reading aloud of the prescribed form of Obligation by one of the Secretaries, the Fellow to be admitted shall subscribe his name to the Obligation in the Obligation book, and be introduced by the Secretary to the Chairman, who, taking him by the hand, and addressing him by name,

shall say:—"By the authority and in the name of the Chemical Society, I admit you a Fellow thereof."

Every Fellow, so long as his annual subscription be not in arrear, shall have the right to be present and to vote at all Meetings of the Society; to propose Candidates for admission into the Society; to receive one copy of the annual publications of the Society; and shall be entitled to the use of the instruments and books in the Society's Library under such restrictions as the Council may deem necessary. He shall have the privilege of introducing to the Ordinary Meetings of the Society two visitors, whose names together with his own name shall be entered in a book kept for that purpose.

British subjects only are eligible as Fellows.

II.—*Of Honorary and Foreign Members.*

Honorary Members shall be recommended to the Society by the Council. They shall be nominated at one Meeting of the Council, and shall be balloted for at some subsequent Meeting of the Council, and if the majority of those voting are in favour of any Candidate, he shall be proposed by the Council to the Society at a subsequent Ordinary Meeting, and be balloted for according to the Rules for the election of Fellows at the Ordinary Meeting following that at which he was recommended for election.

The number of Honorary Members shall not exceed forty. They shall not be required to contribute to the Funds of the Society, but shall be entitled to receive a copy of the annual publications of the Society.

Persons who are not British subjects may be proposed for election as Foreign Members, and may be elected in the manner prescribed for the election of Fellows; such Foreign Members shall pay the same contribution as the Fellows and shall enjoy the same privileges, except that they shall not vote at any Meeting of the Society.

III.—*Of Associates.*

Associates may be of either sex and shall be proposed, balloted for and elected in the same manner as Fellows. They shall not be required to pay an admission fee, but shall pay an annual subscription of Two Pounds, which shall become due on the first day of January in every year. They shall also return to the Secretaries the following Obligation, duly signed:—"I, the undersigned, do hereby engage that

I will endeavour to promote the interests and welfare of the Chemical Society, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue an Associate thereof."

Associates shall have all the ordinary privileges of Fellows so long as their annual subscriptions be not in arrear, except that they shall neither vote at Meetings of the Society nor propose Candidates for election.

IV.—*Of the Resignation, Re-admission, and Removal of Fellows, Honorary Members, Foreign Members and Associates.*

The Council shall have the power to decline to accept the resignation of any Fellow, Foreign Member or Associate so long as any moneys remain due from such person to the Society.

Any Fellow, Foreign Member or Associate who at any Annual General Meeting of the Society shall owe two annual subscriptions, payment whereof shall have been applied for by the Treasurer by means of a notice addressed and posted to each person so in arrear not later than the first day of January immediately preceding such meeting and for the non-payment whereof no reason satisfactory to the Council shall have been given, shall cease to be a Fellow, Foreign Member or Associate of the Society, and the name shall be removed from the Society's List accordingly as from that date: Provided, nevertheless, that on an application for re-admission being addressed to the Council by such person within three years from the date of the removal of the name from the Society's List, the case shall be considered by the Council, who may, if they see fit, reinstate such person as a Fellow, Foreign Member or Associate of the Society as the case may be upon payment of all arrears of subscriptions, or upon payment of the amount of the life composition fee which would have been payable at the date when the first subscription in arrear was due.

No application for re-admission shall be considered by the Council after the lapse of three years from the resignation of a Fellow, Foreign Member or Associate, or from the removal of the name from the Society's List, but such person desiring again to become a Fellow, Foreign Member or Associate may be proposed, balloted for and elected as a new Candidate for election. Provided always that no person whose name was removed from the Society's List for non-payment of subscriptions shall be eligible for re-election until all subscriptions due at the time when the name was removed shall have been paid.

Any proposal to remove the name of a Fellow, Honorary Member, Foreign Member or Associate from the Society's List for other causes than the non-payment of subscriptions must be made by the Council.

It shall be made at an Ordinary Meeting, and the removal be balloted for at the next Ordinary Meeting, and if three-fourths of the Fellows voting shall vote for such removal, the name of the Fellow, Honorary Member, Foreign Member or Associate shall be removed from the Society's List accordingly, provided always that not less than forty Fellows vote on the question of removal.

V.—*Of the Constitution and Election of the Council.*

The President, Vice-Presidents, Treasurer and Secretaries (herein called "the Official Members of Council") and twelve other Fellows (herein called "the Ordinary Members of Council") forming the Council to conduct the business of the Society under the Charter, shall be elected by ballot at the Annual General Meeting, and all Members of the Council shall hold office until the next Annual General Meeting, and be eligible for re-election, except as otherwise provided by the Bye-laws.

The Council may act notwithstanding any casual vacancy in their body so long as the number of Ordinary Members is not reduced below eight.

At the second Ordinary Meeting in February the Chairman shall declare: 1st. The names of the Official and Ordinary Members of Council who become ineligible for the succeeding year, according to the Bye-laws, either for the Council or for specific Offices. 2nd. The names of the President and Official Members recommended by the Council for election to office during the ensuing year, including the names of two new Vice-Presidents selected either from the existing Council or from the general body of Fellows. 3rd. The names of new Ordinary Members recommended by the Council for election in the place of the Ordinary Members becoming ineligible as Ordinary Members or being recommended by the Council for election as Official Members.

Any Fellow or Fellows other than those recommended by the Council may be proposed for election as Official or Ordinary Members on the nomination of ten Fellows. The proposal in writing duly signed by the nominators shall be communicated to one of the Secretaries before the first Ordinary Meeting in March, specifying the name or names of the Candidate or Candidates, and the position (Official or Ordinary) on the Council for which each Candidate is nominated; and the list of names proposed shall be read from the Chair and be publicly suspended in the Society's rooms and circulated among the Fellows with the list recommended by the Council.

No person shall be eligible for any position on the Council unless nominated for that position in accordance with these Bye-laws.

Two lists, according to the Forms Nos. 5 and 6 in the Appendix, with the names of the Fellows recommended for election as Official and Ordinary Members of Council, and having each a blank column opposite for such alterations as any Fellow may wish to make in accordance with these Bye-laws and the instructions on the forms, shall be prepared by the Secretaries. These two lists shall be read from the Chair at the first Ordinary Meeting in March, and, on or before the day of meeting, shall be suspended in the Society's rooms and circulated among the Fellows.

On the day of Election, two Scrutators shall be nominated by the Chairman, with the approbation of the Meeting, to assist the Secretaries in examining the lists. Each Fellow voting shall deliver his list to one of the Scrutators, and the name of the Fellow so voting shall be recorded by one of the Secretaries. The names of those reported to the Chairman by the Scrutators as having the majority of votes of the Fellows present for filling the offices of President, Vice-Presidents, Treasurer, Secretaries and Ordinary Members of Council shall then be announced from the Chair as elected to serve for the ensuing year.

In the event of votes being recorded for the same Candidate, both as an Official and an Ordinary Member of Council, the votes recorded for him as an Official Member shall, in the case of his not being elected an Official Member, be added to those recorded for him as an Ordinary Member of Council, and the total number of votes shall be counted as votes for the Candidate as an Ordinary Member of Council.

VI.—*Of the President.*

It shall be the duty of the President to preside at the Meetings of the Society and of the Council, and to regulate the order of the proceedings.

No Fellow shall be elected as President of the Society for more than two years in succession, but he may be re-elected after the lapse of one year.

In case of a casual vacancy, the Council may elect one of the Vice-Presidents to exercise the Powers and perform the duties of President until the next Annual General Meeting.

VII.—*Of the Vice-Presidents.*

In the absence of the President, the Chair shall be occupied by one of the Vice-Presidents, or, in the absence of any Vice-President, by a Member of Council or some other Fellow.

Fellows who have filled the office of President shall be proposed by the Council for election as Vice-Presidents, and such proposal shall be renewed every year, except when any such Vice-President shall be nominated to the office of President.

There shall also be six Vice-Presidents who have not filled the office of President. At the Annual General Meeting in every year, four only of these Vice-Presidents shall be eligible for election as Members of the Council for the ensuing year, and if a Vice-President (not being a Past President) shall be nominated by the Council for election as President, four of the remaining above-mentioned Vice-Presidents shall be eligible. The Council shall decide which Vice-Presidents or Vice-President shall so be eligible.

In case of a casual vacancy in the number of Vice-Presidents (not being Past Presidents), the Council may elect a Vice-President who shall remain in office until the next Annual General Meeting.

VIII.—*Of the Treasurer.*

The Treasurer shall receive all moneys due to the Society, and shall pay and disburse out of the Society's funds such sums as may be ordered by the Council. He shall keep an account of such receipts and payments, in which donations and moneys received for composition of annual payments shall be entered separately from the ordinary revenues of the Society, and he shall produce such account at any Meeting of the Council, when required.

The Treasurer shall pay all moneys received by him into the hands of the Society's bankers, and shall make up his Accounts to the end of each year for the examination of the Auditors.

The Treasurer shall, before the last day of each year, send to every Fellow and Foreign Member of the Society who has not compounded for his annual contribution, and to every Associate, an intimation that their contributions for the ensuing year become due on the first day of January.

At the second Ordinary Meeting of the Society in February, three Auditors shall be elected by the Society by show of hands unless a ballot be demanded. They shall audit the Treasurer's Accounts, and shall forward their Report to the Council at least one week before the

Annual General Meeting, together with a list, prepared by the Treasurer, of all Fellows, Foreign Members and Associates whose subscriptions are in arrear. They shall have the power of calling for all necessary accounts and vouchers. No member of the Council shall be eligible as an Auditor.

The Council shall fill up any casual vacancy in the office of Treasurer or Auditor occurring in any year.

IX.—*Of the Secretaries.*

There shall be two Secretaries and a Foreign Secretary.

The duties of the Secretaries shall be—1st. To attend, one or both, at all Meetings of the Society and of the Council. 2nd. To take minutes of the proceedings, and to read them at the ensuing Meeting. 3rd. To read at the Ordinary Meetings such Communications to the Society, or abstracts thereof, as the Chairman may direct. 4th. To send to every person elected into the Society notice of his election, and a printed copy of the Obligation, together with a copy of the Charter and Bye-laws of the Society and a List of the Fellows, Honorary Members, Foreign Members and Associates. 5th. To prepare and circulate the Balloting Lists of the Council. 6th. To conduct the home correspondence of the Society, and such other secretarial business as is reasonably to be inferred from the Charter and Bye-laws. The several duties to be performed by each Secretary shall be arranged by the Council.

The Secretaries shall keep the Obligation book and a book containing the Bye-laws with the form of Obligation to be subscribed by each Fellow, Foreign Member or Associate.

The Foreign Secretary shall conduct the foreign correspondence of the Society.

The Council shall fill up any casual vacancy in the Office of Secretary or Foreign Secretary occurring in any year.

X.—*Of the Ordinary Members of Council.*

At the Annual General Meeting in every year eight only of the Ordinary Members of Council shall be eligible for election for the ensuing year. The Council shall decide which eight members shall be eligible. The Council shall as far as possible arrange the rotation and nominations so that three-fourths of the Ordinary Members of Council are resident within sixty miles of the rooms of the Society.

The Council may fill up casual vacancies among the Ordinary Members of Council and shall do so if necessary to prevent the number of Ordinary Members of Council from falling below eight.

XI.—*Of the Proceedings of the Council.*

The Council shall hold their Ordinary Meetings at least once a month, from November to June inclusive.

Extraordinary Meetings of the Council shall be called by the President upon a requisition to him signed by three members of the Council, or at his own discretion, when he shall direct the Secretaries to issue summonses for the occasion.

Notice of the time of holding each Meeting of the Council shall be forwarded by one of the Secretaries to each Member of the Council at least two days previous to that on which such Meeting is to be held, but the non-receipt of such notice by any Member of the Council shall in no way invalidate the proceedings of the Meeting.

Five Members of the Council shall form a quorum at all meetings of the Council.

The ordinary mode of decision on questions before the Council shall be by show of hands, unless a ballot be demanded. Any Member of the Council who shall be personally concerned in the question under consideration shall retire during the discussion and determining of the same and shall not vote thereon.

At the Annual General Meeting, the President shall present the Report of the Council on the state of the Society during the past twelve months.

Before any new Bye-law, or alteration of the existing Bye-laws, be brought before the Society by the Council, it shall be proposed at one Meeting of the Council, and considered and approved of at a subsequent Meeting.

The Council shall have the power of appointing and of removing the Assistant Secretary, Librarian, Curator, and any other paid Officers of the Society, and of determining which of the Officers of the Society shall receive remuneration and the rate thereof and the nature and extent of the service to be rendered by each Officer.

XII.—*Of the Ordinary Meetings of the Society.*

Ordinary Meetings of the Society shall be held twice in every month from November to June inclusive, and if the Council see fit there shall be one Meeting in the month of October, provided that in the

month of January and in the month in which Easter occurs, the Council may dispense with one of the Meetings: the specific days and hours of meeting shall be determined by the Council.

The ordinary course of business shall be as follows, subject, however, to the control of the Chairman for the time being:—1st. The names of the visitors, and of the Fellows or Associates by whom they are introduced, shall be announced from the Chair. 2nd. The Minutes of the proceedings of the previous Meeting shall be read and submitted for confirmation. 3rd. New Fellows shall sign the Obligation book, and shall be admitted by the Chairman. 4th. Presents made to the Society since its last Meeting shall be announced from the Chair. 5th. The certificates of Candidates for election shall be read. 6th. The ballot (if any) for any election shall be opened. 7th. Communications shall be read and discussed.

XIII.—*Of the General Meetings of the Society.*

An Annual General Meeting of the Society shall be held on the 30th day of March, or on some day near that time, and at such an hour as the Council may determine.

An Extraordinary General Meeting of the Society shall be summoned at any time by the President on his receiving a written requisition to do so from the Council or from twenty Fellows of the Society. Notice shall be given of such Meeting at a previous Ordinary Meeting, and by a circular addressed to all the Fellows who have given to the Secretaries an address in the United Kingdom for the purpose of sending publications or notices. The President shall have the power of calling an Extraordinary General Meeting at any time.

At all General Meetings, whether Annual or Extraordinary, no motion of a proposal to alter the Bye-laws shall be considered of which due notice has not been given at least fourteen days previously, either at an Ordinary Meeting, or by Publication in the Proceedings, and in either case by means of a printed notice subsequently addressed to all Fellows having a postal address in the United Kingdom known to the Secretaries.

For the purpose of any alteration of the Bye-laws the quorum of the Meeting, Annual or Extraordinary, shall be sixty.

XIV.—*Of the Reading and Publication of Papers.*

The Secretaries, or one of them, shall mark upon each paper the date on which it was received from the author, and also the date, if

any, on which it was read to the Society. These papers or abstracts thereof, or the titles thereof, shall be read at Ordinary Meetings, and the discussion of each paper shall immediately follow the reading thereof, unless the Chairman for the time being shall otherwise direct. The discussion of any paper may, on a resolution of the Meeting to that effect, be resumed at a subsequent Meeting. The Council may decide that any paper shall not be read at any Meeting.

Papers received during the recess may be ordered for publication by the Council without being read to the Society.

All papers communicated to the Society as aforesaid, with their illustrative Drawings, shall become the property of the Society; and authors shall not be at liberty, save by permission of the Council, to publish in English such papers, until the same, or abstracts thereof, have either appeared in the Journal of the Society, or the Secretaries have notified the authors that the same, or abstracts thereof, will not appear in the Journal of the Society.

The Journal of the Society shall be published at intervals to be determined by the Council. It shall contain such of the papers which have been read at the Meetings of the Society, or abstracts of them, as the Council may determine, together with abstracts of papers published in other Journals.

XV.—*Of the Library.*

The books in the possession of the Society shall be allowed to circulate under such regulations and with such exceptions as the Council may deem advisable.

XVI.—*Of the Common Seal and Deeds.*

The Common Seal of the Society shall remain in the custody of the President. Every Deed or Writing to which the Common Seal is to be affixed shall be passed and sealed in Council.

APPENDIX.

No. 1.

CHEMICAL SOCIETY.

Certificate of a Candidate for Election as a Fellow.

The attention of the Candidate in whose favour this Certificate is made out is specially directed to the fact that, if elected, he will be required to sign the following Obligation, prior to his admission into the Society :—

> OBLIGATION.—I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the CHEMICAL SOCIETY, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue a FELLOW thereof.

Name _____

Usual Place of Residence _____

Designation or Occupation _____

Qualifications.* _____

_____

_____

_____

being desirous of admission into the CHEMICAL SOCIETY, *we, the undersigned, propose and recommend him as a proper person to become a* FELLOW *thereof.*

* Directions for filling up the Certificate are given on the other side.

Dated this _____ *day of* _____ 19

From Personal Knowledge.	From General Knowledge.

Proposed on _____

To be Balloted for on _____

Elected _____ 19

_____

President.

Directions for filling up the Certificate of a Candidate for Election as a Fellow.

Under "Qualifications" should be given a concise statement of the Candidate's contributions to Chemical Science as Investigator or Author, or of his position and past experience as Lecturer, Teacher, Assistant or Student or in connection with Analytical or Manufacturing Chemistry.

If the Candidate's qualifications are not included under any of the above heads, the reasons for his desiring admission to the Society should be stated.

The Certificate must be signed by *five* or more Fellows, of whom *at least three* must certify their recommendation from *personal* knowledge.

*** In conformity with Bye-law I, this Certificate will be published in full in the "Proceedings of the Chemical Society."

No. 2.

CHEMICAL SOCIETY.

Certificate of a Candidate for Election as an Associate.

The attention of the Candidate in whose favour this Certificate is made out is specially directed to the fact that, if elected, will be required to sign the following Obligation prior to admission into the Society :—

> OBLIGATION.—I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the CHEMICAL SOCIETY, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue an ASSOCIATE thereof.

Name _____

Usual Place of Residence _____

Designation or Occupation _____

Qualifications.* _____

_____

_____

_____

being desirous of admission into the CHEMICAL SOCIETY, *we, the undersigned, propose and recommend* _____ *as a proper person to become an* ASSOCIATE *thereof.*

* Directions for filling up the Certificate are given on the other side.

Dated this _____ *day of* _____ 19

From Personal Knowledge.	From General Knowledge.

Proposed on _____

To be Balloted for on _____

Elected _____ 19

_____

President.

Directions for filling up the Certificate of a Candidate for Election as an Associate.

Under "Qualifications" should be given a concise statement of the Candidate's contributions to Chemical Science as Investigator or author, or of position and past experience as Lecturer, Teacher, Assistant or Student or in connection with Analytical or Manufacturing Chemistry.

If the Candidate's qualifications are not included under any of the above heads, the reasons for desiring admission to the Society should be stated.

The Certificate must be signed by *five* or more Fellows, of whom *at least three* must certify their recommendation from *personal* knowledge.

*** In conformity with Bye-law I, this Certificate will be published in full in the "Proceedings of the Chemical Society."

No. 3.

Obligation.

I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the CHEMICAL SOCIETY, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue a FELLOW thereof.

Signed_____

Address_____

In the presence of_____

Address_____

Date_____

No. 4.

Obligation.

I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the CHEMICAL SOCIETY, that I will observe its Laws, and to the utmost of my power maintain its dignity, as long as I shall continue an ASSOCIATE thereof.

Signed_____

Address_____

In the presence of_____

Address_____

Date_____

[*Issued by authority of the Council.*] No. 5. [*March*, 19 .]

Balloting List for the Election of Official Members of Council.

CHEMICAL SOCIETY. — BALLOTING LIST

FOR THE ELECTION OF OFFICIAL MEMBERS OF COUNCIL.

Present.	*Proposed by Council.*	
PRESIDENT.		
VICE-PRESIDENTS WHO HAVE FILLED THE OFFICE OF PRESIDENT.		
VICE-PRESIDENTS.		
TREASURER.		
SECRETARIES.		
FOREIGN SECRETARY.		

The following are names proposed under the Bye-laws for election to the respective offices in lieu of the above:—

PRESIDENT ... ... _____

VICE-PRESIDENTS... _____ _____

TREASURER ... ... _____

SECRETARIES ... ... _____ _____

FOREIGN SECRETARY _____

If you wish to substitute any other name, in place of that proposed by the Council, erase the printed name in the second column, and write opposite to it, in the third, that which you wish to substitute. Erasures without substitution, or substitution of other names than those duly proposed under the Bye-laws, will have no effect.

of other names than those duly proposed under the Bye-laws, will have no effect.

[*Issued by authority of the Council.*] No. 6. [*March*, 19 .]

Balloting List for the Election of Ordinary Members of Council.

CHEMICAL SOCIETY. — BALLOTING LIST

FOR THE ELECTION OF ORDINARY MEMBERS OF COUNCIL.

Present.	*Proposed by Council.*	

The following are names proposed under the Bye-laws in lieu of the above:—

If you wish to substitute any other name, in place of that proposed by the Council, erase the printed name in the second column, and write opposite to it, in the third, that which you wish to substitute. Erasures without substitution, or substitution of any names other than those duly proposed under the Bye-laws, will have no effect.

Before proceeding to invite discussion of the revised Bye-laws, the PRESIDENT said he thought it would be desirable that a short statement of the course of events relating to this matter should be laid before the meeting. It appeared that the last complete revision of the Bye-laws was undertaken in 1878, when the total Membership of the Society, including 1 Associate and 35 Honorary Foreign Members, was 974. With the exception of minor alterations dealing with the issue of the publications of the Society to Fellows whose subscriptions are in arrear, the Bye-laws then adopted are those in force at the present time.

During the last twenty-five years the growth of the Society had been rapid and the need for a complete revision of the Bye-laws had forced itself on the attention of the Council in the course of the last decade, leading eventually in 1897 to the appointment of a Committee to consider the question. In the end no action was taken on the report of the Committee and no further progress was made until June of last year, when the Council appointed a Committee "to revise the Bye-laws." This Committee consisted of the Officers with Mr. David Howard, Dr. Hugo Müller, Professor J. M. Thomson, Dr. T. E. Thorpe, and Mr. Phipson Beale, K.C. In the course of the recess, a comprehensive series of suggestions was made, chiefly by Mr. Beale, to whom the Council were deeply indebted for his valuable assistance. These, together with amendments proposed in writing by other members of the Committee, were circulated among the members of the Committee and were discussed at the first meeting of the Committee on October 26th. Two lengthy meetings were required to complete the first revision. The Bye-laws as revised were circulated among the members of the Committee, and in two meetings the second revision was completed. It should be added that subsequently the revised Bye-laws were submitted to the Society's solicitor, Mr. Carpmael, and three interviews with him took place during the preparation of the final draft which formed the Report of the Committee to the Council.

The Council, as required by Bye-law X, had the Bye-laws before them at two meetings. The revised Bye-laws having been formally proposed on December 14th, 1904, were considered and adopted on January 18th, 1905, Mr. Carpmael being present on the latter occasion to advise the Council during the discussion.

The process of revision had therefore been undertaken by the Council with great deliberation and with every precaution to secure consistency among the new Bye-laws and compliance with the terms of the Charter.

In order to facilitate comprehension of the changes which were proposed, independently of merely verbal amendments, the following

points might be enumerated as representing substantial alterations in the several Bye-laws.

Distinction of Honorary from merely Foreign Members (Bye-law II).

Extension of the Associateship to Women (Bye-law III).

Power to fill up casual vacancies among the Official and Ordinary Members of Council (Bye-laws VI, VII, VIII, IX, and X).

Extension of town membership of Ordinary Members of Council to Fellows resident within 60 miles of the Society's rooms (Bye-law X).

Precise definition of the mode of election of the Council, and of the nomination of Fellows other than those proposed by the Council (Bye-law V).

It was moved by Dr. DIVERS, and seconded by Dr. MOODY:

> That the proposed Bye-laws be sent up to the Council for revision and co-ordination without altering the sense.

This motion was withdrawn.

It was moved by Dr. DIVERS, and seconded by Prof. DUNSTAN:

> That the Bye-laws proposed by the Council be accepted, and the Council requested to carefully consider the suggestions for verbal improvement made by Dr. DIVERS, and to adopt such improvements as can be introduced without legal objection.

As an amendment, it was moved by Mr. D. A. SUTHERLAND, and seconded by a Fellow:

> That the Meeting be adjourned until the Council has considered the suggestions made by Dr. DIVERS.

As a further amendment it was moved by Mr. F. J. LLOYD, and seconded by Dr. BARGER:

> That the proposed Bye-laws be referred back to the Council for further consideration.

This amendment was put to the vote, and by 23 votes to 10 votes it was resolved:

> That the proposed Bye-laws be referred back to the Council for further consideration.

Wednesday, February 15th, 1905. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Mr. A. W. Henzell was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs. :

Arthur Amos, B.A., Spring Grove, Wye, Kent.
William Morris Colles, jun., B.Sc., 16, Birchington Road, West Hampstead, N.W.
Miles Coupe, 46, Millarborn Lane, Waterfoot, near Manchester.
John William Taylor, University College, Reading.

It was announced that the following changes in the Officers and Council were proposed by the Council.

As President: Prof. R. Meldola, F.R.S., *vice* Prof. W. A. Tilden, F.R.S.

As Vice-Presidents: Prof. A. Smithells, F.R.S., and Prof. W. P. Wynne, F.R.S., *vice* Prof. P. F. Frankland, F.R.S., and Prof. R. Meldola, F.R.S.

As Secretary: Prof A. W. Crossley, *vice* Prof. W. P. Wynne, F.R.S.

As Ordinary Members of Council: Mr. E. C. C. Baly, Dr. G. T. Moody, Mr. W. J. Sell, F.R.S., and Dr. J. Wade, *vice* Dr. A. Harden, Dr. J. T. Hewitt, Dr. C. A. Kohn, and Dr. S. Ruhemann.

Mr. E. Grant Hooper, Dr. H. F. Morley, and Dr. J. Wade were elected to audit the Society's accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected.

Andrea Angel, M.A.
Francis William Fredk. Arnaud.
James Henry Ashwell.
James Hector Barnes, B.Sc.
Samuel Henry Clifford Briggs, B.Sc.
James H. Campbell.
Hem Chandra Chatterji, B.A.
F. E. Clarke, Ph.D., B.Sc.
George Douglas Clarkson.
Bernard Collett.
Samuel George Eade.
Charles Richard Gardner.
Herbert Goodier.
Frederick William Healy.
James Alexander Russell Henderson, B.Sc.
Carl Richard Hennings, Ph.D.
Bernard Mount Jones, B.A.
Percy Walter Jones.
Tudor Foulkes Jones, B.Sc.
Herbert Louis Leech.
Joseph Lister, B.Sc.
George Moss Lloyd, M.A., M.Sc.
Edward William Lucas.
Alfred Courtenay Luck.
Andrew Norman Meldrum, D.Sc.

William Sloan Mills, M.A.
Charles Watson Moore, B.Sc.
Thomas Pennycuick, B.Sc.
Bert Perrott.
Frank Lee Pyman, B.Sc., Ph.D.
Ernest Quant.
William Henry Ratcliffe, B.Sc.
Frederick George Richards.
Harold Rudolph Rogers, B.A.
Fred Scholefield, B.Sc.
Harold Schröder.
John Irwin Scott, B.A.
William Dunham Seaton.
William Herbert Simmons, B.Sc.
Gustav Arthur Troyc.
William Phillip Want.
Eric H. Weiskopf.
Ernest Wheeler.
John Henry Becker Wigginton.
John Wells Wilkinson, M.A.
Alan Herbert Williams.

Of the following papers, those marked * were read:

***16. "Nitrogen halogen derivatives of the aliphatic diamines." By Frederick Daniel Chattaway.**

Although the quinonedichloroimides, obtained from the aromatic diamines, were among the earliest studied nitrogen halogen compounds, no derivatives of the aliphatic diamines have hitherto been described. Both the diamines themselves and the diacyldiamines, however, readily yield such substances in which the whole of the hydrogen attached to nitrogen is replaced by halogen, and a number of such derivatives of ethylenediamine and trimethylenediamine have been prepared. The most noteworthy of the compounds described were ethylenetetrachlorodiamine, $NCl_2 \cdot CH_2 \cdot CH_2 \cdot NCl_2$, and ethylenetetrabromodiamine,

$$NBr_2 \cdot CH_2 \cdot CH_2 \cdot NBr_2;$$

both are stable substances, the former a liquid giving off peculiarly irritating vapours, the latter a well crystallised solid.

***17. "The nitration of substituted azophenols." By John Theodore Hewitt and Herbert Victor Mitchell.**

The authors have systematically studied the action of dilute nitric acid and of a mixture of concentrated nitric and sulphuric acids on the three nitrobenzeneazophenols. With dilute nitric acid, substitution takes place in the ortho-position with respect to the hydroxyl group in each case (compare *Trans.*, 1900, **77**, 99; 1901, **79**, 49, 155); it is, however, remarkable that the concentrated mixed acids have the same effect.

This result contradicts Noelting's statement (*Ber.*, 1887, **20**, 2997) to the effect that if benzeneazophenol is dissolved in concentrated sulphuric acid and treated with one molecule of nitric acid, *p*-nitrobenzeneazophenol results; whilst with two molecules of nitric acid a product is obtained identical with that derived from the diazotisation of 2 : 4-dinitroaniline and subsequent coupling with phenol.

Whilst Noelting is correct in stating that the first nitro-group enters the benzene nucleus in the para-position with respect to the azo-group, he is obviously wrong as to the position assumed by the second nitro-group, since *p*-nitrobenzeneazophenol, when dissolved in concentrated sulphuric acid and treated with one molecular proportion of nitric acid, furnishes a product which melts at the same temperature and does not depress the melting point of the product of coupling *p*-nitrophenyldiazonium salts with *o*-nitrophenol.

The evidence as to the constitution of the product obtained by nitrating *m*-nitrobenzeneazophenol is as follows: (i) the same product is obtained by nitration with strong and dilute acids, (ii) it has the same melting point as the product obtained by the action of strong sulphuric acid on 3 : 3′-dinitroazoxybenzene.

o-*Nitrobenzeneazo-o-nitrophenol* (m. p. 187°) has been obtained not only by nitration of *o*-nitrobenzeneazophenol, but also by coupling *o*-nitrophenyldiazonium sulphate with *o*-nitrophenol; its *acetyl* and *benzoyl* derivatives melt at 119° and 174° respectively.

m-Nitrobenzeneazo-*o*-nitrophenol melts at 179°; its *acetyl* and *benzoyl* derivatives melt at 138° and 169° respectively.

p-Nitrobenzeneazo-*o*-nitrophenol melts at 212° (Noelting gives 200°); its *acetyl* and *benzoyl* derivatives melt at 138° and 179° respectively.

2-*Nitrotoluene*-4-*azophenol* melts at 186°, its *acetyl* derivative at 113°. 3-*Nitrotoluene*-4-*azophenol* melts at 158°.

The last two azo-compounds have been obtained by coupling the diazotised nitro-*p*-toluidines with phenol, but not by nitrating *p*-toluene-azophenol.

***18. "The estimation of saccharin." By Charles Proctor.**

The "sulphate" and "salicylic acid" methods of estimating saccharin are troublesome, and require great attention to details in order to obtain satisfactory results.

The process described by E. Emmet Reid (*Amer. Chem. Journal*, 1899, **21**, 461) for the estimation of real saccharin (*o*-benzoicsulphinide), by boiling with dilute acid (which hydrolyses this compound to the acid ammonium salt of sulphobenzoic acid) and then distilling off and estimating the ammonia so produced, has been tested and found to be convenient and reliable.

The paper also describes a simple volumetric process by means of which the combined percentage of real saccharin (*o*-benzoicsulphinide) and *p*-sulphamidobenzoic acid in commercial samples and mixtures containing saccharin can be readily determined. This process depends on the liberation of iodine by both real saccharin and *p*-sulphamido-benzoic acid, when either or both are mixed with a solution containing potassium iodide and iodate.

By a combination of this "iodine process" with the "ammonia process," the separate percentages of "para-" and "ortho-saccharin" can be readily determined, and then indirectly that of any unaltered sulphonamide, &c.

19. "The analysis of samples of milk referred to the Government Laboratory in connection with the Sale of Food and Drugs Acts." By Thomas Edward Thorpe.

In connection with the administration of the Sale of Food and Drugs Acts, samples of milk are frequently referred by magistrates to the Government Laboratory for examination. These referred samples are invariably sour when received, and it is therefore of importance to determine whether this fact prevents a true inference as to the character of the fresh milk or interferes with the determination of the degree of sophistication to which the milk may have been subjected.

The charges usually brought against milk by public analysts are that it has been mixed with water or that fat has been abstracted. The proof or disproof of the allegation depends upon a determination in the sample of the amount of fat and of the non-fatty solids.

As regards the fat, it would appear that bacteria producing steatolytic enzymes do not develop to any considerable extent in sour milk. Direct experiments show that any action they may produce is too inconsiderable to affect to any substantial extent the experimental proof of the validity of any charge based upon an alleged deficiency in fat.

As regards a charge based upon an alleged deficiency of non-fatty solids, as the aggregate weight of the non-fatty solids is affected to some extent by the fermentative changes associated with the souring, it has been necessary to examine these changes in some degree of detail with a view to ascertain their bearing upon the experimental facts needed to establish the inference of sophistication, and to determine its extent.

This communication contains the results of such an examination. It serves to establish the character of the products of the change in so far as they affect the quantitative results, describes how they may be determined, and what is the nature and amount of the correction needed to account for the slight loss in the non-fatty solids which generally results on keeping the milk.

20. "The condensation of anilinodiacetic esters in presence of sodium ethoxide." By Alfred Theophilus de Mouilpied.

The esters and half-esters of anilino- and toluidino-diacetic acids and anilinoacetylpropionic acid and certain of its esters were prepared and

condensed either alone or in the presence of benzaldehyde or ethyl oxalate by means of sodium ethoxide.

Sodium ethoxide does not bring about ring formation in the case of the anilinodiacetic esters, these substances behaving like glutaric esters.

Ethyl anilinoacetylpropionate loses one molecule of alcohol and gives ethyl phenyloxypyrrolinecarboxylate; this ester on saponification gives the acid, which in its turn loses carbon dioxide on heating. In alcoholic solutions, sodium ethoxide only saponifies the esters.

With benzaldehyde, ethyl anilinodiacetate condenses to a lactone having the constitution $CO<^{CH_2\cdot NPh}_{O-CHPh}>CH\cdot CO_2Et$, which yields the acid on saponification.

Alcoholic solutions of anilino- and toluidino-diacetic esters, when treated with ammonia, yield the corresponding diamides.

Sodium ethoxide readily brings about a condensation between ethyl anilinodiacetate and ethyl oxalate, yielding a substance having very different properties from the ketopentamethylene derivatives obtained by Dieckmann with ethyl glutarate. The product has the composition $C_{16}H_{17}O_6N$ and probably a quinonoid structure. On using methyl oxalate, a different compound was obtained, as also on substituting sodium methoxide for the ethoxide. Similar experiments were carried out with methyl anilinodiacetate.

21. "The basic properties of oxygen at low temperatures: additive compounds of the halogens with organic substances containing oxygen." By Douglas McIntosh.

It was previously shown (Walker, McIntosh, and Archibald, *Trans.*, 1904, **85**, 1098; Archibald and McIntosh, 1904, **85**, 919) that organic compounds containing oxygen united, at low temperatures, with the halogen hydrides to form definite compounds. Continuing these low temperature experiments with chlorine and bromine, the following compounds were made:

	M. p.		M. p.
CH_4OBr	−55°	$(CH_3)_2COCl_2$.....	−53°
C_2H_6OBr	−61	$(CH_3)_2CO)_2Br_3$	−12
$(C_2H_5)_2OCl_2$	−51	$CH_3\cdot CO_2(C_2H_5)Cl_3$ ...	−64
$(CH_3)_2OBr_2$	−68	$CH_3\cdot CO_2(C_2H_5)Br_3$ ...	−39
$(C_2H_5)_2OBr_2$.....	−40	$(CH_3\cdot COH)_3Cl_2$(?) ...	−11

These formulæ must, in some cases, be doubled in order to represent

the constitutions of the compounds with oxygen as a quadrivalent element.

These substances are formed with the evolution of a small amount of heat, have definite melting points, and crystallise in needles or prisms. At a low temperature (– 80°), there is no substitution and only additive compounds are produced.

Compounds of chlorine with the alcohols and with methyl ether were not obtained, but would doubtless crystallise out at a lower temperature. Compounds were made with the halogens and acetic acid, but difficulty was experienced in preventing the acetic acid from being precipitated, so that the analyses varied widely and showed a large amount of acid present. The halogens form compounds with acetaldehyde, but these are quickly decomposed and a mixture of meta- and para-acetaldehydes results. Iodine is the most powerful of the halogens in bringing about this change, whereas chlorine is the least.

22. "Organic derivatives of silicon." By Frederic Stanley Kipping.

The continuation of this work (*Proc.*, 1904, 20, 15), in which the author has been assisted by Mr. A. Hunter, has led to the preparation of a number of compounds of which the following is a brief preliminary account; for the purpose of systematic nomenclature, these compounds may be conveniently regarded as derivatives of *silicane*, SiH_4, or of *silicol*, $SiH_3{\cdot}OH$.

Diphenylethylchlorosilicane, $SiEtPh_2Cl$, is obtained as a by-product in the preparation of phenylethyldichlorosilicane (phenylethylsilicon dichloride); it is a fuming liquid boiling at about 240° (115 mm.).

Phenylethylpropylchlorosilicane, SiEtPrPhCl, is the principal product of the interaction of phenylethyldichlorosilicane and magnesium propyl bromide; it boils at about 255°, but has not been obtained quite free from impurity.

Phenylmethylethylpropylsilicane, SiMeEtPrPh, is obtained when the preceding compound is treated with magnesium methyl iodide; it is a mobile liquid, boiling at 229—231°, and is decomposed by sulphuric acid giving, apparently, benzene and *methylethylpropylsilicol*, $SiMeEtPr{\cdot}OH$.

Phenylbenzylethylpropylsilicane, SiEtPrPhBz, prepared from magnesium benzyl chloride and phenylethylpropylchlorosilicane, is a colourless liquid, boiling at 249—251° (100 mm.), and is readily decomposed by sulphuric acid, giving benzene and *benzylethylpropylsilicol*, $SiEtPrBz{\cdot}OH$, or the corresponding *ether*, $(SiEtPrBz)_2O$.

When this decomposition product of phenylbenzylethylpropylsilicane is heated with sulphuric acid, it undergoes sulphonation, giving apparently various acids of which hitherto only one has been isolated. This

compound seems to be benzylethylpropylsilicolsulphonic acid and has apparently the composition $SiEtPr(OH)\cdot CH_2\cdot C_6H_4\cdot SO_3H$, but it may be derived from the corresponding ether (see below); its *ammonium* salt crystallises well in colourless plates and is very readily soluble in water; its *barium* salt separates from aqueous alcohol in well-defined crystals and is almost insoluble in water; its l-*menthylamine* salt crystallises well from aqueous alcohol and melts at about 230°; its *bornylamine* salt also crystallises well and melts at about 211°; the salts of most of the alkaloids do not crystallise readily.

Benzylethyldichlorosilicane, $SiEtBzCl_2$, prepared by treating ethyltrichlorosilicane with magnesium benzyl chloride, is a colourless, fuming liquid boiling at 168—170° (100 mm.), and is separated from the other products of higher boiling point, which no doubt contain *dibenzylethylchlorosilicane*, $SiEtBz_2Cl$, by fractional distillation; it is decomposed by water giving the corresponding silico-ketone, *benzylethylsilicone*, SiEtBzO, a colourless oil.

Benzylethylpropylchlorosilicane, SiEtPrBzCl, is obtained by the interaction of the preceding compound and magnesium propyl bromide; it boils at about 194—196° (100 mm.), but is not easily obtained in a state of purity. When decomposed with water, it gives two compounds, one of which, probably the *ether*, $(SiEtPrBz)_2O$, boils at about 255° (25 mm.); the principal product, however, is *benzylethylpropylsilicol*, $SiEtPrBz\cdot OH$, a colourless, mobile liquid which boils at about 155° (25 mm.).

This alcohol is readily sulphonated, giving apparently at least two sulphonic acids, one of which has been isolated in the form of its salts and found to be identical with the compound described above, which is obtained from the decomposition product of phenylbenzylethylpropylsilicane.

This fact seems to prove that the sulphonic acid in question is, as stated, a derivative of benzylethylpropylsilicol, but molecular weight determinations made with its ammonium salt indicate that polymerisation or condensation has occurred.

Benzylmethylethylpropylsilicane, SiMeEtPrBz, is formed when benzylethylpropylchlorosilicane is treated with magnesium methyl iodide; it is a mobile liquid boiling at about 250°.

The main object of this investigation being the preparation of an optically active compound containing an asymmetric silicon group (compare Kipping and Lloyd, *Trans.*, 1901, **79**, 449), most of the work described in this note is of a preliminary character, and the intermediate compounds have not yet been carefully examined.

23. "Photographic radiation of some mercury compounds." By Robert de Jersey Fleming-Struthers and James Ernest Marsh.

The mercury compound $HgC_2N_2,2(NH_2{\cdot}NH{\cdot}C_6H_5)$ was found to act on a photographic plate even through a sheet of paper in a few hours, forming a deep black patch on development. When a perforated sheet of zinc was enclosed between two pieces of paper and interposed, the action was exerted through the perforations and the substance of the paper. The position occupied by the perforations was dense black; the rest of the film was only slightly affected owing to an action of the metallic zinc.

This mercury compound also acted strongly at some distance from the plate, even through a layer of aluminium foil. Through a disc of quartz, there appeared at the first attempt a just perceptible darkening, but on repeating the experiment the result was negative.

The substance was placed over strong sulphuric acid to test for loss due to evaporation; this proved to be extremely small.

The generators of the compound were tested separately: the action of phenylhydrazine was more sluggish and diffused than that of the compound; the behaviour of mercuric cyanide was less definite, some specimens being active, others inactive; the active specimens lost their activity after heating. Mercuric cyanide was distilled in a high vacuum without decomposition; the distillate was inactive, even the most volatile portions. Inactive cyanide recovered its activity when slightly moistened with water; if covered with water, it was inactive.

Mercuric cyanide prepared from inactive mercuric oxide and hydrocyanic acid was active. Mercuric chloride was active, and retained its activity when distilled, both the distillate and residue being active. Mercuric bromide and mercuric and mercurous nitrates were active. Mercuric iodide, sulphate, acetate, sulphide, oxide, and mercuric ammonium chloride were inactive, or at the most very slightly active; as were also mercurous chloride, sulphate, acetate, and oxide. Redistilled metallic mercury had no action whatever on a gelatine dry plate; cuprous silver and potassium cyanides were also inactive.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

English Ceramic Society. Transactions, embracing papers and discussions for season 1903–4. pp. 115. ill. Longton 1905.
From the Society.

Ostwald, W. Conversations on chemistry. Authorised translation by Elizabeth Catherine Ramsay. Part I. General chemistry. First edition. pp. viii + 250. ill. London 1905. (*Recd.* 13/2/05.)
From the Publishers.

Sundbärg, Gustav. Sweden, its people and its industry. pp. xi + 1142. ill. Stockholm 1904. (*Recd.* 2/2/05.)
From the Swedish Government.

II. *By Purchase.*

Allen, Alfred H. Commercial organic analysis. A treatise on the properties, proximate analytical examination, and modes of assaying the various organic chemicals and products employed in the arts, manufactures, medicine, &c., with concise methods for the detection and determination of their impurities, adulterants, and products of decomposition. 3rd edition. Vol. 1. With revisions and addenda by the author and Henry Leffmann. Introduction, alcohols, neutral alcoholic derivatives, sugars, starch and its isomers, vegetable acids, &c. Vol. 2. With revisions and addenda by the author and Henry Leffmann. Part 1. Fixed oils, fats, waxes, glycerol, nitroglycerin, and nitroglycerin explosives. Part 2. Hydrocarbons, petroleum and coal-tar products, asphalt, phenols and creosotes. Vol. 3. Revised and edited by J. Merritt Matthews. Part 1. Tannins, dyes and colouring matters, writing inks. pp. xii + 557, x + 387, viii + 330, xii + 589. ill. London (printed in America) 1898—1901. (*Recd.* 10/2/05.)

Barnet book of photography. A collection of practical articles. pp. 287. ill. London 1903. (*Recd.* 10/2/05.)

Beck, Conrad, and Andrews, Herbert. Photographic lenses. 5th edition. pp. 270. ill. London [1903]. (*Recd.* 10/2/05.)

Brown, Adrian J. Laboratory studies for brewing students. A systematic course of practical work in the scientific principles underlying the processes of malting and brewing. pp. xviii + 193. ill. London 1904. (*Recd.* 10/2/05.)

Classen, A. Ausgewählte Methoden der analytischen Chemie. Unter

Mitwirkung von H. Cloeren. Band I. pp. xx + 940. ill. Braunschweig 1901. (*Recd.* 10/2/05.)

Cole, R. S. A treatise on photographic optics. pp. 330. ill. London 1899. (*Recd.* 10/2/05.)

Le Chatelier, H., and Boudouard, O. High-temperature measurements. Authorised translation and additions by G. K. Burgess. 2nd edition. pp. xv + 341. ill. New York 1904. (*Recd.* 10/2/05.)

Mitchell, C. Ainsworth, and Hepworth, T. C. Inks: their composition and manufacture, including methods of examination, and a full list of English patents. pp. xiv + 251. ill. London 1904. (*Recd* 10/2/05.)

Osmond, Floris, and Stead, J. E. Microscopic analysis of metals. pp. x + 178. ill. London 1904. (*Recd.* 10/2/05.)

Pringle, Andrew. Practical photo-micrography. pp. 179. ill. London 1902. (*Recd.* 10/2/05.)

Wall, E. J. The dictionary of photography. Revised and brought up to date by Thos. Bolas. 8th edition. pp. 656. ill. London 1902. (*Recd.* 10/2/05.)

Watts, W. Marshall. An introduction to the study of spectrum analysis. pp. vii + 325. ill. London 1904. (*Recd.* 10/2/05.)

III. *Pamphlets.*

Collins, S. H. Variation in the chemical composition of the swede (From the *J. of Agric. Science*, **1**, 1905.)

Feder, Erich. Beiträge zur Kenntnis der Basicität der Alkaloide, geprüft an ihrer Wirkung auf gewisse Oxydationsvorgänge. Strassburg 1904.

Hooper, David. Rusot: an ancient Eastern medicine. (From the *Journal, Asiatic Society of Bengal*, **73**, 1904.)

Jackson, A. H. Water softening. pp. 20. Melbourne 1904.

Sodeau, William H. Notes on some temperature regulators. (From the *J. Soc. Chem. Ind.*, **23**, 1904.)

Voorhees, Edward B. The use of fertilisers. A review of the results of experiments with nitrate of soda. (New Jersey Agric. Exper. Stations, Bulletin 172.)

Webster, C. S. Stanford. Luminescope for comparing substances under the influence of radium rays. (From the *J. Soc. Chem. Ind.*, **23**, 1904.)

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Métropole, at 6.30 for 7 o'clock, on **Wednesday, March 29th, 1905** (the day fixed for the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

All applications for tickets should be made not later than **Wednesday, March 22nd** next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, addressed and made payable to the Assistant Secretary, Chemical Society, Burlington House, London, W.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society for the election of Officers and other business will be held on **Wednesday, March 29th, 1905, at half-past four** o'clock in the afternoon.

At the next Ordinary Meeting, on **Thursday**, March **2nd**, 1905, at **8** p.m., the following papers will be communicated:

"The latent heat of evaporation of benzene and some other compounds." By J. Campbell Brown.

"The relation between natural and synthetical glycerylphosphoric acids." By F. B. Power and F. Tutin.

"The reduction of *iso*phthalic acid." By W. H. Perkin, jun., and S. S. Pickles.

"The transmutation of geometrical isomerides." By A. W. Stewart.

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Issued 10/3/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 291.

Thursday, March 2nd, 1905. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Messrs. Robert J. Caldwell, Edward Evans, Lewis Eynon, and E. J. Fairhall were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

John George Baxter, Court Sole, Cliffe, Nr. Rochester, Kent.
Roger Dodds, Bigods Hall, Dunmow, Essex.
Sydney Dunstan, 107, Jesmond Road, Newcastle-on-Tyne.
Albert Gillies, Government Laboratories, Johannesburg, S. Africa.
Henry Isaac Gorman, 126, Quay, Waterford.
Ernest Green, 113, Hulton Street, Moss Side, Manchester.
John Hawthorne, 7, Roseneath Villas, Military Road, Cork.
Arthur Lonsdale Hetherington, B.A., Government Collegiate School, Rangoon, Burma.
Sydney A. Kay, D.Sc., 72, Market Street, St. Andrew's.
Leonard Gibbs Killby, B.A., 10, Aberdeen Park, Highbury, N.
Ernest Isaac Lewis, B.A., B.Sc., Felstead School, Felstead.
Alfons O'Farrelly, M.A., 3, Holles Street, Dublin.
William Sarginson, B.Sc., 200, Cauldon Road, Stoke-on-Trent.
Robert Reed Swann, B.Sc., The Agricultural College, Aspatria, Cumberland.

Of the following papers, those marked * were read :

***24. "The relation between natural and synthetical glycerylphosphoric acids." By Frederick Belding Power and Frank Tutin.**

Glycerylphosphoric acid was first prepared synthetically by Pelouze (*Compt. rend.*, 1845, **21**, 718, and *J. pr. Chem.*, 1845, **36**, 257), who, from the analyses of some of its salts, concluded that it was identical with that obtained from lecithin.

By the interaction of glycerol and phosphoric acid, it is possible that several esters may be formed, and three of these are now known, namely: the mono-ester, or glycerylphosphoric acid, $C_3H_5(OH)_2 \cdot O \cdot PO(OH)_2$; the so-called di-ester,

$$C_3H_5(OH)\begin{<}O\\O\end{>}PO(OH);$$

and the tri-ester, $C_3H_5{:}PO_4$.

The authors have shown that the discrepancies of statement respecting the composition and characters of the salts of glycerylphosphoric acid (compare Portes and Prunier, *J. Pharm. Chim.*, 1894, **29**, 393; Petit and Polonowsky, *ibid.*, 1894, **30**, 193; and Adrian and Trillat, *ibid.*, 1898, **7**, 226) are due, as has been suggested by Carré (*Compt. rend.*, 1903, **137**, 1070), to their contamination with salts of the above-mentioned di-ester. It was therefore deemed of interest to ascertain the characters of the salts of glycerylphosphoric acid when prepared under such conditions as are known to exclude the formation of the di-ester, and a number of these have been described and analysed.

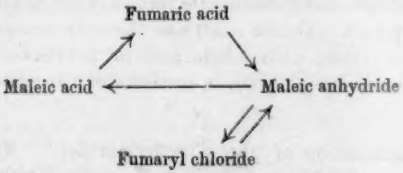
In the course of the authors' work, Willstätter and Lüdecke described an investigation (*Ber.*, 1904, **37**, 3753) in which they compared the barium and calcium salts of the natural and synthetical glycerylphosphoric acids, and came to the conclusion that the differences between them are not those which are usually observed in the case of optically active and racemic compounds. These differences consisted in the amount of metal contained in the respective salts, in the varying amounts of water believed to be retained by them when dried at certain temperatures, and in their relative solubility in water.

The authors have shown, however, that the conclusions of Willstätter and Lüdecke are not valid, inasmuch as their synthetical glycerylphosphoric acid was prepared under conditions which are known to afford some of the di-ester, and that the discrepancies they have observed are to a large extent due to the contamination of their salts of the synthetical acid with those of the di-ester rather than to the amount of water retained by them when subjected to heat.

The fact was also noted that the natural glycerylphosphoric acid has in no instance been prepared from a lecithin which was known to be a pure individual substance. Although the preparations obtained from this source by Willstätter and Lüdecke possessed optical activity, which proved the presence of the unsymmetrical acid, no evidence can as yet be adduced that they did not contain some of the symmetrical isomeride.

***25. "The transmutation of geometrical isomerides." By Alfred Walter Stewart.**

In order to explain this series of phenomena, the author assumes as a phase of the reaction the formation and disruption of a tetramethylene compound. In the case of maleic and fumaric acids, the intermediate compound would be a tetramethylene-1 : 2 : 3 : 4-tetracarboxylic acid, in which, probably, the carboxyl groups attached to the 1 : 2-carbon atoms would lie on the side of the ring opposite to those attached to the 3 : 4-atoms. Such a tetramethylene ring might split up in two ways; either by breaking the linkings between 1 and 2, 3 and 4; or by breaking those joining 1 to 4 and 2 to 3. In the former case, fumaric acid is formed; in the latter, maleic acid is regenerated. If, however, fumaric acid is produced, owing to its higher melting point, it is immediately withdrawn from further action, while maleic acid is free to undergo the same series of changes. Fumaric acid, when distilled in presence of phosphoric oxide, is assumed to form the same type of tetramethylene derivative; but in this case water is abstracted from the carboxyl groups attached to the 1 : 2-carbon atoms, and also from those attached to the 3 : 4-atoms, the groups in each pair being in the *cis*-position to one another. Owing to the presence of the two anhydride chains, the tetramethylene ring cannot now break across in either of two ways, as in the last case, and consequently its disruption produces maleic anhydride. The complete series of changes:



can be thus explained; and also the transformations undergone by stereoisomeric oximes, hydrazones, and diazo-compounds. The author gives instances in which the tetramethylene intermediate product has actually been isolated, when it is found that its behaviour fulfils the conditions required by the hypothesis.

Discussion.

Dr. Colman pointed out that tetramethylene-mono- and -di-carboxylic acids are very stable substances, and that it therefore hardly seemed probable that the tetramethylenetetracarboxylic acid, assumed by the author to be the intermediate product between fumaric acid and maleic anhydride, would be so readily resolved quantitatively into two molecules of maleic acid.

***26. "Linin." By James Stuart Hills and William Palmer Wynne.**

According to Pagenstecher (*Buchner's Repert. Pharm.*, 1840, **72**, 311; 1842, **76**, 313; 1843, **79**, 216) and Schröder (*Neues Repert. Pharm.*, 1861, **10**, 11), purging flax (*Linum catharticum*), a small indigenous herb, contains a substance, linin, to which the former investigator attributed the purgative properties of the drug.

The authors believe the active principle to be a glucoside, which, however, has not been isolated in a pure state owing to its uncrystallisable nature. On hydrolysis with dilute acids or with lime, the glucoside is resolved into glucose and a substance which, so far as the comparison can be made, seems to be identical with Schröder's linin. The yield of crude linin amounts to about 0·13 per cent. by weight of the drug.

Linin, $C_{23}H_{24}O_9$ (mol. wt. 445 and 451 in naphthalene; 453 and 437 by the boiling point method in acetone), crystallises from alcohol in needles, and melts at about 203°, the exact melting point depending on the mode of heating; it is insoluble in water, sparingly soluble in the usual organic solvents, and gives a deep purple coloration with concentrated sulphuric acid. It contains four methoxyl groups, as determined by the Zeisel method; the demethylated derivative proved to be uncrystallisable. Attempts to prepare acetyl and benzoyl derivatives of linin were fruitless, and inconclusive results were obtained by fusion with caustic potash. Oxalic acid was the only recognisable product when it was oxidised with nitric acid or potassium permanganate under varied conditions. Linin is destitute of purgative properties.

***27. "The constitution of phenylmethylacridol." By James Johnston Dobbie and Charles Kenneth Tinkler.**

When phenylacridine methiodide is treated with an alkali, a hydroxide is formed which was supposed at one time to be the base corresponding with the original salt. Hantzsch, however, from the results of conductivity experiments, concluded that it is really a carbinol formed by

the shifting of the hydroxyl group from the nitrogen atom to an adjacent carbon atom at the moment of precipitation. Confirmation of this view is afforded by the fact that whilst the absorption spectra of phenylacridine methiodide and of the hydroxide derived from it differ widely, the spectra of the latter substance agree very closely with those of dihydrophenylacridine. This resemblance is inexplicable unless we regard the hydroxide as a carbinol bearing the same relation to dihydrophenylacridine that cotarnine bears to hydrocotarnine or hydrastinine to hydrohydrastinine (*Trans.*, 1903, **83**, 598; 1904, 85, 1005).

28. "The ultra-violet absorption spectra of certain diazo-compounds in relation to their constitution." By James Johnston Dobbie and Charles Kenneth Tinkler.

The authors have applied the spectroscopic method to the investigation of isomerism in the diazo-group. They find that the stable and unstable forms of the isomeric diazosulphonates and of the isomeric diazocyanides derived from *p*-anisidine and *p*-chloroaniline give identical spectra, or spectra agreeing more closely than those of any isomerides which differ structurally from one another. They regard this result as affording confirmation of the correctness of Hantzsch's view according to which these substances are *syn*- and *anti*-modifications, differing from one another in the same way as the *syn*- and *anti*-oximes. On the other hand, the isomeric potassium benzenediazotates, as also the two forms of the potassium compound obtained from diazotised sulphanilic acid, give widely different spectra. The spectra of the more stable (Schraube and Schmidt's) potassium benzenediazotate are almost identical with those of phenylmethylnitrosoamine, from which the authors infer that these compounds are constituted alike and are represented respectively by the formulæ $C_6H_5 \cdot NK \cdot NO$ and $C_6H_5 \cdot N(CH_3) \cdot NO$.

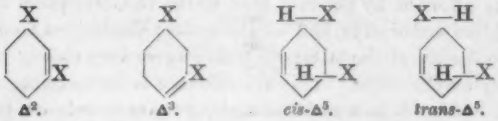
29. "The latent heat of evaporation of benzene and some other compounds." By James Campbell Brown.

An improved apparatus has been employed in determining exactly the latent heat of benzene and its homologues. The latent heats of *tert.*-amyl alcohol and propyl *iso*butyrate are also recorded, together with Trouton's values (compare *Trans.*, 1903, **83**, 987).

30. "The reduction of *iso*phthalic acid" By William Henry Perkin, jun., and Samuel Shrowder Pickles.

When *iso*phthalic acid is reduced with sodium amalgam at 45°, it yields two tetrahydro-acids (Δ^2 and *cis*-Δ^5), and, from these, two

further acids are obtained by the methods mentioned below. Since there can only be four tetrahydro*iso*phthalic acids, namely :



it follows that the authors have been successful in isolating all the possible modifications.

Δ²-*Tetrahydroisophthalic acid* melts at 168°, is very soluble in water, and is characterised by yielding a rather sparingly soluble calcium salt and an anhydride which melts at 78° ; it combines with hydrogen bromide and with bromine to form 2-bromohexahydro*iso*phthalic acid (m. p. 185—187°) and 2 : 3-dibromohexahydro*iso*phthalic acid (m. p. 202°) respectively. When oxidised first with permanganate and then with chromic acid, it yields succinic acid.

Δ³-*Tetrahydroisophthalic acid* is produced when the other tetrahydro*iso*phthalic acids are boiled with strong caustic potash, intramolecular change taking place ; it melts at 244° and is very sparingly soluble in water. When it is digested with acetic anhydride and then distilled, it is converted into the anhydride of the Δ²-acid. It combines with hydrogen bromide with difficulty, yielding a syrup which appears to be 4-bromohexahydro*iso*phthalic acid and readily absorbs bromine vapour with formation of 3 : 4-dibromohexahydro*iso*phthalic acid (m. p. about 230°). The latter acid is decomposed by boiling with caustic potash with formation of a dihydro*iso*phthalic acid which melts at 255° and is very sparingly soluble in water. When the Δ³-tetrahydro-acid is oxidised with permanganate or with nitric acid, it yields *iso*phthalic and oxalic acids.

cis-Δ⁵-*Tetrahydroisophthalic acid* melts at about 165°, is very readily soluble in water and, when digested with acetic anhydride and distilled, yields the anhydride of the Δ²-acid. It combines with bromine with formation of 5 : 6-dibromo-*cis*-hexahydro*iso*phthalic acid, which melts at about 220°.

trans-Δ⁵-*Tetrahydroisophthalic acid* is produced when the *cis*-acid is heated with hydrochloric acid at 170°. It melts at 225—227°, is very sparingly soluble in water, and combines with bromine to form 5 : 6-dibromo-*trans*-hexahydro*iso*phthalic acid, which decomposes at about 230—235°.

The reasons which have led the authors to assign to the various tetrahydro*iso*phthalic acids the constitutions given above are discussed in the detailed paper.

31. "The influence of temperature on the interaction between acetyl thiocyanate and certain bases. Thiocarbamides, including carboxy-aromatic groups." By the late Robert Elliott Doran (compiled by Augustus Edward Dixon).

Miquel's acetyl thiocyanate (*Ann. Chim. Phys.*, 1877, [v], **11**, 295), when brought into contact at low temperature with aniline dissolved in benzene, showed little sign of thiocarbimidic character, the principal change being the following double decomposition: $AcSCN + 2PhNH_2 = PhNH_2,HSCN + AcNHPh$. On the other hand, when these materials were caused to interact at higher temperatures, the thiocyanic character diminished and the thiocarbimidic reaction increased, until, in the neighbourhood of 85°, about 90 per cent. of the additive-compound (acetylphenylthiocarbamide) was obtained, according to the equation $AcNCS + PhNH_2 = AcNH{\cdot}CS{\cdot}NHPh$.

With *o*-toluidine this was not the case, an experiment conducted at 85° giving 91 per cent. of the available sulphur in the form of acetyl-*o*-tolylthiocarbamide, whilst at −3° the yield of this substance was only a few per cent. less.

By combining acetyl thiocyanate with methylaniline in hot benzene, *acetylmethylphenylthiourea* was obtained in white crystals melting at 93—94°. *Acetylphenylbenzylthiourea* separated from dilute alcohol in fine, rhombic crystals melting at 110—111°. Piperidine gave no acetylpiperidylthiourea, but piperidylthiourea instead, together with piperidyl thiocyanate; the former melted at 126—127°, the temperature given by Wallach (*Ber.*, 1899, **32**, 1872), and by treatment with acetic anhydride yielded the *acetyl* derivative, $AcN{:}C(SH){\cdot}NC_5H_{10}$ (long prisms, melting at 112—113°). By passing ammonia gas through a boiling solution of acetyl thiocyanate in benzene, 21 per cent. of the available sulphur was obtained as acetylthiourea, $AcN{:}C(SH){\cdot}NH_2$.

Phenyl chlorocarbonate, PhO·COCl, when dissolved in benzene and left in contact with potassium thiocyanate until free from halogen, gave a solution of *carboxyphenylthiocarbimide*; by treatment with methylamine, this afforded *carboxyphenylmethylthiocarbamide*,

PhO·CO·NH·CS·NHMe

(long, glistening prisms melting at 175—176°), isomeric with the author's carboxymethylphenylthiocarbamide, MeO·CO·NH·CS·NHPh (m. p. 158°) (*Trans.*, 1901, **79**, 908).

Carboxyphenylisoamylthiocarbamide is a crystalline solid (m. p. 99—100°), isomeric with carboxy*iso*amylphenylthiocarbamide (*loc. cit.*, 914).

Phenylcarboxyphenylthiocarbamide, PhO·CO·NH·CS·NHPh, was obtained (*a*) from aniline, and (*b*) by expelling by means of phenyl

chlorocarbonate the acetyl group from acetylphenylthiocarbamide; it melted at 148—149°.

Carboxyguaiacolphenylthiocarbamide,

$$MeO\cdot C_6H_4O\cdot CO\cdot NH\cdot CS\cdot NHPh,$$

from guaiacol chlorocarbonate and acetylphenylthiocarbamide, melted at 154—155° and was freely desulphurised by warming with alkaline lead solution.

32. "The influence of solvents on the rotation of optically active compounds. Part VIII. Ethyl tartrate in chloroform." By Thomas Stewart Patterson.

Data relative to the rotation of ethyl tartrate in chloroform at various concentrations and temperatures are given. Chloroform has a marked effect in depressing the rotation of the ester. It is shown that the variation of rotation is in agreement with the change in solution-volume of the dissolved tartrate.

33. "A further note on the addition of sodium hydrogen sulphite to ketonic compounds." By Alfred Walter Stewart.

The author has applied the method already described (*Trans.*, 1905, 87, 185) to some other compounds containing the carbonyl group.

The rate of addition of sodium hydrogen sulphite to ethyl acetoacetate having already been found to be much more rapid than was anticipated, it was thought advisable to try experiments with diethyl acetonedicarboxylate. The results were as follows:

After 10	20	30	40	50	60	70 minutes.
40·2	55·3	61·0	64·5	68·1	71·2	73·0

per cent. of bisulphite compound.

Comparing this with the numbers already found in the cases of acetone and ethyl acetoacetate, it appears that the replacement of hydrogen by a carboxyl group increases the velocity of addition, and when a second carboxyl group is introduced instead of another hydrogen atom, the velocity is further accelerated. This seemed to point to the addition of sodium hydrogen sulphite to the carboxyl group itself, but when this hypothesis was tested by determining the addition of sodium hydrogen sulphite to ethyl acetate, no interaction could be detected.

Diacetylacetone and acetonylacetone were also tried, one equivalent

of sodium hydrogen sulphite solution for each carbonyl group present being used. The percentages for each carbonyl group were :

Bisulphite compound.	After 10	20	30	40	50	60 minutes.
Diacetylacetone...	14·6	17·8	21·3	23·9	26·3	27·8 per cent.
Acetonylacetone...	5·7	8·8	11·5	14·6	16·6	19·5 „

Potassium β-camphorsulphonate, prepared by Reychler's method (*Bull. Soc. chim.*, 1898, [iii], **19**, 120), gave a constant value of 3·5 per cent.

The figures for maltose, glucose, and lactose are :

	After 10	20	30 minutes.
Maltose ...	2·6	2·9	3·1 per cent. of bisulphite compound.
Glucose ...	5·2	5·2	5·2 „ „
Lactose ...	7·7	8·4	9·0 „ „

Unsuccessful attempts to prove the existence of additive products were made with epichlorohydrin, carbamide, acetamide, formamide, allyl alcohol, and ethyl cinnamate. Dimethylpyrone gave traces of some additive compound, but concordant results were not obtained.

34. "Action of hydrogen peroxide on carbohydrates in the presence of ferrous sulphate. Part V." By Robert Selby Morrell and Albert Ernest Bellars.

In this communication, attempts have been made to trace the disappearance of different sugars during their oxidation by observing the decrease in the rotation angle, and from the determination of the initial and final reducing powers of the solutions, as well as their acidities, to obtain a fuller knowledge of the many oxidation stages which occur. The results of the change in the optical activity show that during successive additions of hydrogen peroxide up to 1 gram-molecule for the same weight of carbohydrate, the decrease in the angle is proportional to the amount of oxidising agent added. The relative diminution in the angle depends on the sugar oxidised; galactose shows a greater decrease than glucose or fructose, maltose less than sucrose, which, in turn, has a smaller decrease than lactose. Rhamnose becomes lævorotatory on oxidation, and the rotation is practically constant after 2 gram-atoms of oxygen have been added. The high values of the final reducing powers must be due to the strong reducing powers of keto-acids and osones formed in the oxidation. The acidities of the solutions after oxidation are not large, and are insufficient to account even for the complete formation of one monobasic hexose acid.

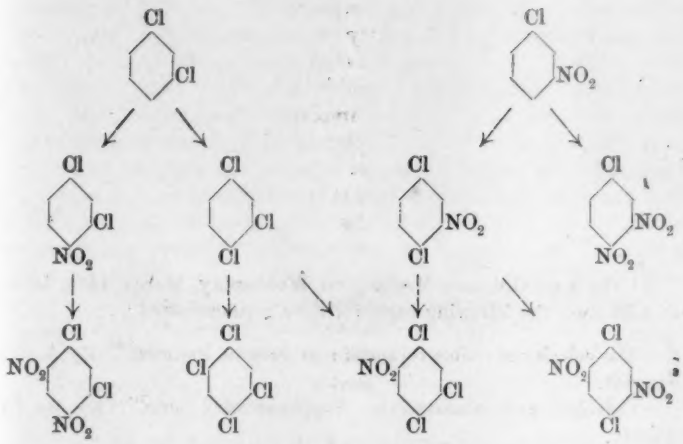
The smaller the yield of osazone precipitated by phenylhydrazine in the cold, the greater is the acidity of the solution. Attempts were made in the case of arabinose and rhamnose to isolate the acids formed during the oxidation. The simpler acids, formic and oxalic, were easily detected, but the more important keto-acids which were expected could not be isolated, although qualitative experiments leave little doubt as to their presence. Fischer's method (*Ber.*, 1902, **35**, 3141) has been applied to the formation of arabinosone from arabinose, rhamnosone from rhamnose, and by using *o*-nitrobenzaldehyde, glucosazone and rhamnosazone may be made to yield the corresponding osones.

Radium emanations were found to have no influence on the oxidation of fructose. When the conditions were arranged so that change in the concentration of the solutions became impossible, the optical activity of the sugar remained constant.

35. "Studies in chlorination. The chlorination of the isomeric chloronitrobenzenes." By Julius Berend Cohen and Hugh Garner Bennett.

In a recent paper by Cohen and Dakin (*Trans.*, 1904, **85**, 1274), attention was directed to the relation which was found to subsist between the position assumed by the third and fourth entrant chlorine atoms obtained by chlorinating *o*- and *p*-dichlorobenzenes and the six isomeric dichlorotoluenes, on the one hand, and those occupied by the two entrant nitro-groups on the other, and again by the fourth chlorine atom and nitro-group in the case of 1 : 2 : 4-trichlorobenzene and the six trichlorotoluenes.

The investigation has now been extended to the chlorination of *m*-dichlorobenzene and the mono- and di-chloronitrobenzenes. The results show remarkable conformity with the above rule, and no single exception has been recorded. It therefore follows that when the first two hydrogen atoms of benzene or toluene have been substituted by either two chlorine atoms or by one chlorine atom and one nitro-group, the positions occupied by subsequent chlorine atoms or nitro-groups are the same. The principal table of results is too long to reproduce, but that of the derivatives of *m*-dichloro- and *m*-chloro-nitrobenzenes will serve to illustrate the rule. The only secondary product recorded in this table is *p*-dichloro-*p*-dinitrobenzene. The remainder represent the sole products of each reaction :



ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Métropole, at 6.30 for 7 o'clock, on **Wednesday, March 29th, 1905** (the day fixed for the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

All applications for tickets should be made not later than **Wednesday, March 22nd** next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, addressed and made payable to the Assistant Secretary, Chemical Society, Burlington House, London, W.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society for the election of Officers and other business will be held on **Wednesday, March 29th 1905, at half-past four** o'clock in the afternoon.

At the next Ordinary Meeting, on **Wednesday**, March **15th**, 1905, at **5.30** p.m., the following papers will be communicated :

"The velocity of oxime formation in certain ketones." By A. W. Stewart.

"Catechin and acacatechin. Supplementary note." By A. G. Perkin.

"The action of ethyl dibromopropanetetracarboxylate on the disodium compound of ethyl propanetetracarboxylate. A correction." By W. H. Perkin, jun.

"Glutaconic acid and the conversion of glutaric acid into trimethylenedicarboxylic acid." By G. Tattersall.

"The ultra-violet absorption spectra of certain enol-keto-tautomerides." By E. C. C. Baly and C. H. Desch.

"Esterification constants of substituted acrylic acids." By J. J. Sudborough and D. J. Roberts.

"α-Chlorocinnamic acids." By J. J. Sudborough and T. C. James.

"Di-ortho-substituted benzoic acids. Part VI. Conversion of methyl into ethyl esters." By J. J. Sudborough and T. H. Davies.

"A simple method for the estimation of acetyl groups." By J. J. Sudborough and W. Thomas.

"Gynocardin, a new cyanogenetic glucoside." By F. B. Power and F. H. Lees.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 27/3/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 292.

Wednesday, March 15th, 1905. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Messrs. A. G. Levy, F. L. Pyman, G. W. Monier-Williams, and W. H. Woodcock were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Frank Standish Findon, M.A., B.Sc., 41, Great Percy Street, Holford Square, W.C.
Edwin Morris, 12, Dragon View, Harrogate.
Frank Shedden, B.Sc., 5, Belvedere Road, Walsall.
George Devenish Thomas, B.Sc., 8, Hubert Terrace, Dover.

The PRESIDENT announced that Professor Percy Frankland had presented to the Society the eudiometer made and used by the late Sir Edward Frankland for the analysis of ethyl in 1849; that Professor Retzius, of Stockholm, had presented an engraving of Berzelius; and that Mr. Oscar Guttmann had presented a bronze medal struck in honour of Roger Bacon in Paris in 1818. The Council, on behalf of the Society, had expressed their thanks for these gifts.

Of the following papers, those marked * were read :

***36. "The velocity of oxime formation in certain ketones." By Alfred Walter Stewart.**

With the object of gaining confirmation of the results already obtained in the case of the addition of sodium hydrogen sulphite to various ketones (this vol., p. 13), the author has investigated the rates of formation of the corresponding series of oximes. Solutions of the ketones were allowed to interact with a hydroxylamine sulphate solution for a fixed time, and the amount of free hydroxylamine was then estimated by warming with iodine solution and sodium phosphate and titrating with standard thiosulphate. The principal results are shown in the following table :

	After 10	20	30 minutes.
	Percentage of oxime.		
Acetone	45·1	49·7	50·0
Methyl ethyl ketone ...	36·6	39·2	39·2
Methyl *iso*propyl ketone	31·4	31·5	32·0
Pinacolin	12·9	17·0	24·5

The results are generally in agreement with those already found for the addition of sodium hydrogen sulphite to ketonic compounds, and since chemically the two reactions belong to different types, it seems probable that the hindrance to the reactions in the case of ketones containing many methyl groups near the carbonyl is due to stereochemical and not to purely chemical causes.

***37. "The ultra-violet absorption spectra of certain enol-keto-tautomerides. Part II." By Edward Charles Cyril Baly and Cecil Henry Desch.**

In the first part of this investigation (*Trans.*, 1904, **85**, 1029), the ultra-violet absorption spectra of acetylacetone and ethyl acetoacetate and of certain of their derivatives were described. Evidence was then brought forward in support of the view that the absorption band exhibited by these substances is due to the equilibrium existing between the two possible tautomeric forms. Neither of the two modifications when in a pure state gives an absorption band, but when the two are present together in mutual equilibrium, that is to say, when a number of molecules are changing from one form into the other, a very decided absorption band is developed. The oscillation frequency of the light absorbed was further shown to be independent of the mass of the atom in the so-called labile condition.

The conclusions drawn in the first paper are now shown to be fully confirmed by an investigation into the absorption spectra of benzoylacetone, ethyl benzoylacetate, ethyl acetylsuccinate, ethyl diacetylsuccinate, ethyl oxaloacetate, ethyl acetonedicarboxylate, and ethyl benzoylsuccinate, together with certain of their derivatives. These results favour the view that the absorption band is due to the change of linking taking place when one tautomeric form passes into the other. It is possible to account for the formation of the absorption band by adopting the physical conception of the atoms as a system of electrons, and in this way the formation of the bands is placed in the same category as other spectral phenomena.

Some light is thrown on the dissociation of salts in solution by these results, and it appears probable that dissolved salts are not dissociated into independent ions, but that the two parts of the molecule are merely drawn apart to a certain extent by the action of the solvent. When the two parts are sufficiently separated to allow of the interchange of parts between adjacent molecules, then the condition known as ionisation exists. It is possible to have degrees of dissociation without any evidence such as is required by the electrolytic dissociation hypothesis; such degrees of dissociation no doubt occur in the case of organic compounds, which react apparently by means of ions, but the solutions of which present no evidences of the presence of the ions.

The aliphatic tautomeric compounds in solution present also a type of dissociation without the presence of ions. The labile atom is only drawn away from the rest of the molecule sufficiently to allow an interchange to occur between two different parts of the same molecule. The labile atom is a potential ion. Four grades of dissociation may be recognised.

Discussion.

Sir W. Ramsay remarked that the late Prof. Fitzgerald used to contend that the positive and negative ions could not be regarded as entirely independent entities, but must have some physical connection with each other. The "Faraday" tube spoken of by Mr. Baly may be taken as such a connection. If it be asked how far it is possible to stretch a "Faraday" tube, when one atom, positively charged, may be taken as independent of a negatively charged atom with which it was originally in union, the answer is that the atoms, formerly partners, may be separated by air, glass, or any material. Thus if an experiment suggested by Prof. Ostwald be conceived, in which the + and − ions of a solution of potassium chloride are present in different vessels, physicists would contend that the "Faraday" tube joining them would exist however far the ions be removed one from the other.

***38. "Esterification constants of substituted acrylic acids." By John Joseph Sudborough and David James Roberts.**

The esterification constants of some 22 substituted acrylic and allied acids with methyl alcohol have been determined at 15°. The following compounds were examined: crotonic, cinnamic, *allo*cinnamic, β-chlorocrotonic, β-chloro*iso*crotonic, α-chlorocrotonic, methyl hydrogen fumarate, methyl hydrogen maleate, atropic, α-phenylcinnamic, α-phenyl*allo*cinnamic, α-bromocinnamic, α-bromo*allo*cinnamic, β-bromocinnamic, β-brom*allo*cinnamic, α-chlorocinnamic, α-chloro*allo*cinnamic, β-chlorocinnamic, β-chloro*allo*cinnamic, furfurylacrylic, and *allo*furfurylacrylic, *n*-butyric, hydrocinnamic, and phenylpropiolic acids.

The results indicate that a substituted acrylic acid is esterified much less readily than the corresponding saturated acid, and somewhat more readily than the corresponding acetylenic acid,

$$R\cdot CH_2\cdot CH_2\cdot CO_2H > R\cdot CH{:}CH\cdot CO_2H > R\cdot C{\equiv}C\cdot CO_2H.$$

The effect of introducing substituents into acrylic acid is to lower the rate of esterification. This effect is the most marked when the substituent is in the α-position with respect to carboxyl. A comparison of the constants for pairs of stereoisomeric acids, for example,

$$\begin{matrix} H\cdot C\cdot Y \\ \| \\ X\cdot C\cdot CO_2H \end{matrix} \quad \text{and} \quad \begin{matrix} Y\cdot C\cdot H \\ \| \\ X\cdot C\cdot CO_2H \end{matrix},$$

shows that the acid with CO_2H and Y in *cis*-position is esterified much less readily than when these substituents are in the *trans*-position. A similar relationship appears to hold good for pairs of acids, $Y\cdot CH{:}CH\cdot CO_2H$, with the exception of cinnamic and *allo*cinnamic acids, which have exactly the same esterification constant.

No general relationships have been established hitherto between the pairs of acids,

$$\begin{matrix} X\cdot C\cdot Y \\ \| \\ H\cdot C\cdot CO_2H \end{matrix} \quad \text{and} \quad \begin{matrix} Y\cdot C\cdot X \\ \| \\ H\cdot C\cdot CO_2H \end{matrix}.$$

***39. "α-Chlorocinnamic acids." By John Joseph Sudborough and Thomas Campbell James.**

The action of alkalis on cinnamic acid dichloride and its methyl ester has been studied. The product is a mixture of α-chloro- and α-chloro*allo*-cinnamic acids, and the relative amounts of the two vary but little with the temperature or with the alkali. Even when the acid dichloride is acted on at low temperatures, the amount of α-chloro-acid (m. p. 137°) is considerable, and is raised to only a very small extent by substituting the methyl ester for the acid dichloride. Cinnamic acid dichloride does not show the same tendency to eliminate carbon

dioxide as was observed with the dibromide, and hence the amount of chlorocinnamene is practically nil unless the reaction proceeds at a high temperature.

The velocities with which α-bromo-, α-chloro-, α-bromo*allo*-, and α-chloro*allo*-cinnamic acids are acted on by aqueous potassium hydroxide have been determined.

The methyl ester, chloride, amide, anilide, *p*-toluidide, and α-naphthalide of the α-chloro-acid and the chloride and amide of the α-chloro-*allo*-acid have been prepared.

Phenylpropiolic acid may be prepared by heating the α-chloro-acid with 20 per cent. aqueous caustic potash (2·5 mols.) at 100° for 8 hours; the yield is about 50 per cent. of the theoretical amount, as carbon dioxide is evolved and an oil formed.

***40. "Diortho-substituted benzoic acid. Part VI. Conversion of methyl into ethyl esters." By John Joseph Sudborough and Thomas Huws Davies.**

Purdie has shown that methyl esters of aliphatic acids are readily transformed into the corresponding ethyl esters by means of ethyl alcohol and a small amount of sodium or sodium ethoxide. The methyl esters of substituted benzoic acids can be transformed in a similar manner provided the two ortho-positions with respect to the carbmethoxy-group are not occupied. Thus, the methyl esters of *p*-nitro-, *m*-nitro-, 3 : 5-dinitro-, 3 : 5-dibromo-, 3 : 5-dibromo-4-amino-, and 3 : 4 : 5-tribromo-benzoic acids have been converted into the corresponding ethyl esters, and the ethyl esters of *m*-nitro-, *p*-nitro-, 3 : 5-dinitro-, *p*-bromo-, 3 : 5-dibromo-4-amino-, 3 : 4 : 5-tribromo-benzoic acids have been converted into the corresponding methyl esters by means of methyl alcohol and a small amount of sodium methoxide.

Methyl 2 : 6-dibromobenzoate, methyl 2 : 4 : 6-tribromobenzoate, methyl 2 : 4 : 6-trinitrobenzoate, and ethyl 2 : 4 : 6-tribromo-3-aminobenzoate could not be transformed in this way.

Discussion.

Dr. Cain said that he was rather of the opinion that in the *o*-substituted compounds described by the author a linking might occur between an oxygen and a bromine atom, the former becoming tetradic and the latter triadic, thus hindering or even altogether preventing the formation of an additive compound.

***41. "Simple method for the estimation of acetyl groups." By John Joseph Sudborough and Walter Thomas.**

The acetyl derivative (0·5—1·0 gram) is added to a 10 per cent. solution of pure benzenesulphonic acid and the mixture subjected to steam distillation until the distillate is no longer acid. With *O*-acetyl derivatives, this usually takes 1—2 hours if the steam is passed through somewhat rapidly. The distillate is then neutralised by means of standard barium hydroxide, using phenolphthalein as indicator. Satisfactory results have been obtained with acetyl-α-naphthol, diacetylquinol, triacetylpyrogallol, hexa-acetylmannitol, and triacetylgallic acid.

N-Acetyl groups may be estimated in a similar manner, but the operation takes somewhat longer, especially in the case of mono- or di-acetyltribromoaniline, the retardation being due to the influence of the ortho-substituents. Good results have been obtained with acetanilide, mono- and di-aceto-*o*-toluidides, the corresponding *p*-compounds, diacetyl-ψ-cumidine, and the acetyl derivatives of α- and β-naphthylamines.

It is essential that the benzenesulphonic acid should be pure. The purification is readily accomplished by dissolving the barium salt in hot water, blowing steam through the solution until the distillate is neutral, allowing the barium salt to crystallise, and decomposing it with the theoretical amount of sulphuric acid.

Naphthalene-α- and -β-sulphonic acids may be used instead of the benzenesulphonic acid.

***42. "Gynocardin, a new cyanogenetic glucoside." By Frederick Belding Power and Frederic Herbert Lees.**

The cyanogenetic glucoside, *gynocardin*, the isolation of which from the seeds of *Gynocardia odorata* (R. Br.) has previously been recorded (Power and Gornall, *Proc.*, 1904, **20**, 137), has now been further studied by the present authors.

Gynocardia seeds in contact with water afforded an amount of hydrogen cyanide equivalent to 0·44 per cent. of the entire seed or 0·63 per cent. of the kernels. The yield of crystalline glucoside was about 5 per cent. of the weight of the seeds.

Gynocardin separates from water in colourless, glistening, prismatic needles containing $1\frac{1}{2}H_2O$, which it loses at 115°. The anhydrous substance has the formula $C_{13}H_{19}O_9N$, melts at 162—163°, and has $[\alpha]_D^{20°} + 72·5°$ in aqueous solution.

Hepta-acetylgynocardin, $C_{13}H_{12}O_9(C_2H_3O)_7N$, forms needles melting at 118—119°, and having $[\alpha]_D + 40{\cdot}4°$ in chloroform.

Gynocardin is readily hydrolysed at the ordinary temperature by *gynocardase*, the enzyme isolated from the seeds, but with difficulty by boiling 5 per cent. hydrochloric or sulphuric acid, according to the equation:

$$C_{13}H_{19}O_9N + H_2O = C_6H_{12}O_6 + C_6H_8O_4 + HCN.$$

Among the products of hydrolysis by either acids or the enzyme, it has been possible to isolate only *d*-glucose and hydrogen cyanide, the third substance, $C_6H_8O_4$, readily undergoing secondary decomposition with the formation of amorphous matter. By its comparatively great stability towards acid hydrolysing agents, gynocardin differs in a marked manner from the four other known members of its class (compare Dunstan and Henry, *Phil. Trans.*, 1901, **194**, 515; 1902, **199**, 399, and *Proc. Roy. Soc.*, 1903, **72**, 285).

Gynocardin is readily hydrolysed by barium hydroxide with the formation of crystalline *barium gynocardinate*, $(C_{12}H_{19}O_9{\cdot}CO_2)_2Ba$, and ammonia, according to the equation:

$$C_{13}H_{19}O_9N + 2H_2O = C_{12}H_{19}O_9{\cdot}CO_2H + NH_3.$$

Gynocardinic acid, $C_{12}H_{19}O_9{\cdot}CO_2H$, forms a syrup which does not reduce Fehling's solution and is dextrorotatory; it is hydrolysed by acids in accordance with the equation:

$$C_{12}H_{19}O_9{\cdot}CO_2H + H_2O = C_6H_{12}O_6 + C_7H_{10}O_6.$$

d-Glucose and an *acid* are thus formed. The latter could be isolated in the form of its *quinine* salt, $C_{20}H_{24}O_2N_2,C_7H_{10}O_6$, which crystallised in needles melting at 224° with decomposition. This salt, however, could only be separated in such small amount from the sugar which accompanied it that it has been impossible to determine the constitution of the acid $C_7H_{10}O_6$.

The foregoing results point, however, to the conclusion that gynocardin is the *d*-glucose ether of the cyanohydrin of either a trihydroxyaldehyde, $C_5H_4(OH)_3{\cdot}CHO$, or a ketone, $C_5H_5(OH)_3{\cdot}CO$, respectively. In accordance with this view, the constitution of gynocardin can be represented by one of the following formulæ:

$C_5H_4(OH)_3{\cdot}CH(CN){\cdot}O{\cdot}C_6H_{11}O_5$ or $C_5H_5(OH)_3{\cdot}C(CN){\cdot}O{\cdot}C_6H_{11}O_5$.

Gynocardin is devoid of any appreciable physiological action.

43. "Catechin and acacatechin. Supplementary note." By Arthur George Perkin.

As previously found, catechin (from Gambier catechu), when dried at 100°, melts at 175—177°, and Clauser's statement (*Ber.*, 1903, **36**, 101) that anhydrous catechin melts at 210° could not be substantiated.

Acacatechin, $C_{15}H_{14}O_6,3H_2O$, dried over sulphuric acid, loses $1H_2O$, and differs from catechin, $C_{15}H_{14}O_6,4H_2O$, which under these conditions evolves $3H_2O$. *Acacatechin tetramethyl ether* yields the acetyl compound, $C_{15}H_9O_6(CH_3)_4{\cdot}C_2H_3O$ (colourless needles, m. p. 135—137°), and on oxidation with potassium permanganate gives *veratric acid* and another substance, which is probably *phloroglucinol dimethyl ether*. Catechin tetramethyl ether behaves similarly. With sulphuric or hydrochloric acid in the presence of acetic acid, catechin and acacatechin give an orange-red anhydride having the same composition in both cases (C = 63·26; H = 3·89; and C = 63·33; H = 3·94 respectively), which is insoluble in alkaline solutions and the usual solvents, but which is not identical with the "catechuretin" of Kraut and Delden (*Annalen*, 1863, **128**, 270) and Etti (*Annalen*, 1887, **186**, 332). When oxidised with potassium ferricyanide in the presence of an alkali acetate, both catechins yield a new colouring matter, which dyes mordanted fabrics in orange-brown shades.

44. "The action of ethyl dibromopropanetetracarboxylate on the disodium derivative of ethyl propanetetracarboxylate. A correction." By William Henry Perkin, jun.

A short time ago (*Trans.*, 1903, **83**, 780), T. W. D. Gregory and the author published the results of a research on the above decomposition, and stated that the product of the reaction was *ethyl hexamethyleneoctocarboxylate*, $\begin{matrix}(CO_2Et)_2C{\cdot}CH_2{\cdot}C(CO_2Et)_2\\ (CO_2Et)_2C{\cdot}CH_2{\cdot}C(CO_2Et)_2\end{matrix}$. Dr. Max Guthzeit has called the attention of the present author to the fact that this interpretation is incorrect, and that the substance actually formed is *ethyl trimethylenetetracarboxylate*,

$$(CO_2Et)_2C\begin{matrix}CH_2\\ \diagup\quad\diagdown\end{matrix}C(CO_2Et)_2.$$

The substances described by Gregory and Perkin as hexamethylene derivatives are therefore in reality trimethylene compounds.

This remarkable formation of the trimethylene ring is discussed in the detailed paper.

45. "Glutaconic acid and the conversion of glutaric acid into trimethylenedicarboxylic acid." By William Henry Perkin, jun., and George Tattersall.

Glutaconic acid has hitherto only been obtained in one modification, although stereochemical theory indicates that the two modifications,

$$\begin{array}{l} H\cdot C\cdot CH_2\cdot CO_2H \\ H\cdot C\cdot CO_2H \end{array}$$ *cis.* and $$\begin{array}{l} H\cdot C\cdot CH_2\cdot CO_2H \\ CO_2H\cdot C\cdot H \end{array}$$ *trans.*,

corresponding with fumaric and maleic acids, should exist.

Ordinary glutaconic acid (m. p. 134°) is the *cis*-modification, since it yields an anhydride which, under reduced pressure, distils without decomposition and on hydrolysis yields the same acid (compare Buchner, *Ber.*, 1890, **23**, 706).

The authors have been engaged in a series of investigations with the object of preparing the unknown or *trans*-modification of glutaconic acid, but without success.

When glutaconic acid is distilled, it decomposes partially into vinylacetic acid, $CH_2:CH\cdot CH_2\cdot CO_2H$, and carbon dioxide, but when heated with water at 180°, the decomposition takes place in another direction, and crotonic acid (m. p. 72°) results.

β-Hydroxyglutaric acid, $CO_2H\cdot CH_2\cdot CH(OH)\cdot CH_2\cdot CO_2H$, on distillation, yields a mixture of *cis*-glutaconic acid and its anhydride, and, when treated successively with phosphorus pentachloride and alcohol, it is converted into *ethyl β-chloroglutarate*,

$$CO_2Et\cdot CH_2\cdot CHCl\cdot CH_2\cdot CO_2Et,$$

which, when digested with diethylaniline and subsequently hydrolysed, regenerates *cis*-glutaconic acid.

Ethyl α-bromoglutarate, $CO_2Et\cdot CHBr\cdot CH_2\cdot CH_2\cdot CO_2Et$, is obtained from glutaric acid by bromination and subsequent esterification. When this ester is digested with diethylaniline and subsequently hydrolysed, or when simply hydrolysed with alcoholic potash, it yields *trans-trimethylenedicarboxylic acid* (m. p. 175°), $CH_2<\begin{matrix} CH\cdot CO_2H \\ CH\cdot CO_2H \end{matrix}$ (compare Bowtell and Perkin, *Proc.*, 1899, **15**, 241). Ethyl α-iodoglutarate, obtained from the bromo-ester by digesting with potassium iodide, behaves in exactly the same manner.

46. "The transformations of highly substituted nitroaminobenzenes." By Kennedy Joseph Previté Orton and Alice Emily Smith.

The *s*-trisubstituted nitroaminobenzenes do not undergo the isomeric change into nitroanilines characteristic of less substituted nitroaminobenzenes, since the ortho- and para-positions in the benzene nucleus relative to the amino-group are occupied. In some cases, for example, 1-nitroamino-*s*-tribromobenzene, a nitroaniline is produced by displacement of a bromine atom by the nitro-group under the same conditions in which the isomeric change is effected, namely, in acetic acid solution

in the presence of sulphuric acid (*Trans.*, 1902, **81**, 490, 806). In other cases, a more complex decomposition takes place. For example, *s*-trichloronitroaminobenzene, which is obtained from *s*-trichloroaniline, yields *s*-trichlorobenzenediazonium salt, ammonia, and *s-trichlorophenyl-imino*-2 : 3 : 6-*trichlorobenzoquinone*, $C_6H_2Cl_3{\cdot}N{:}C_6HCl_2{:}O$, the two latter being in molecular proportions. The iminoquinone crystallises from petroleum in red crystals melting at 143°; on reduction, it is converted into 2 : 4 : 6 : 2′ : 3′ : 6′-*hexachloro*-4-*hydroxydiphenylamine*,

$$C_6H_2Cl_3{\cdot}NH{\cdot}C_6HCl_3{\cdot}OH,$$

which crystallises in long, colourless needles melting at 186°. When hydrolysed by sulphuric acid, the iminobenzoquinone is converted into molecular proportions of *s*-trichloroaniline and 2 : 3 : 6-trichlorobenzoquinone.

Since in all cases the acetic acid solutions of nitroaminobenzenes, on treatment with sulphuric acid, yield magenta, purple, or indigo-blue solutions from which are obtained on dilution nitroanilines or substituted phenyliminoquinones, according as the ortho- and para-positions with respect to the imino-group are occupied by other groups, it seems probable that analogous compounds, possibly quinone derivatives, are always present in these solutions; from these intermediary substances are produced, on the one hand, the nitroanilines, or, on the other, the iminoquinone derivatives.

47. "An asymmetric synthesis of quadrivalent sulphur." By Samuel Smiles.

The *l*-menthyl ester of methylethylthetine bromide was prepared from *l*-menthyl bromoacetate and methyl ethyl sulphide. It was found that (*a*) the product yields an inactive methylethylthetine on saponification with silver oxide or with cold concentrated hydrochloric acid; (*b*) that the molecular rotatory power of the product lies nearly halfway between those of the dimethyl and diethyl derivatives, and that this relation is also shown by the corresponding platinichlorides; (*c*) that the platinichloride of *dl*-methylethylthetine *l*-menthyl ester bromide, when prepared from *l*-menthol and the acid bromide of *dl*-methylethylthetine, has the same rotatory power as the platinichloride made from the product of asymmetric synthesis.

Hence it is concluded that the two isomeric *d*- and *l*-methylethylthetine *l*-menthyl ester bromides are produced in equal amount from the interaction of methyl ethyl sulphide and *l*-menthyl bromoacetate.

l-*Menthyl bromoacetate*, a colourless oil boiling at 144—145°/12 mm., has a sp. gr. 1·208 at 25°/4° and $[\alpha]_D^{25°} - 61{\cdot}98°$ and $[M]_D^{25°} - 171{\cdot}68°$; when dissolved in alcohol ($c = 12{\cdot}21$), $[\alpha]_D^{24°}$ is $-62{\cdot}24°$ and $[M]_D$ $-172{\cdot}4°$.

Dimethylthetine l-*menthyl ester bromide*, $(CH_3)_2SBr\cdot CH_2\cdot CO_2\cdot C_{10}H_{19}$, melts at 87—90° with decomposition; in absolute alcohol, it has $[M]_D - 157{\cdot}9°$, and in 50 per cent. alcohol $[M]_D - 162{\cdot}7°$, and in acetone solution $[M]_D - 159{\cdot}2°$; the *chloride* has $[M]_D - 162{\cdot}0°$ approximately; the *hydroxide* is an oil which slowly decomposes into menthol and dimethylthetine. The *platinichloride* melts at 177° and in epichlorohydrin gives $[M]_D - 371{\cdot}3°$.

dl-*Methylethylthetine* l-*menthyl ester bromide*,

$$CH_3\cdot SBr(C_2H_5)\cdot CH_2\cdot CO_2\cdot C_{10}H_{19},$$

melts at 80—82° and in alcoholic solution has $[M]_D - 162{\cdot}7°$. Its *platinichloride* melts at 173—174° and has $[M]_D - 351{\cdot}0°$ in epichlorohydrin.

Diethylthetine l-*menthyl ester bromide*, $(C_2H_5)_2SBr\cdot CH_2\cdot CO_2\cdot C_{10}H_{19}$, melts at 73—74° and has $[M]_D - 169{\cdot}0°$ in alcoholic solution. The *platinichloride* melts at 148—149°, and a solution in epichlorohydrin gave $[M]_D - 331{\cdot}9°$.

48. "The action of α-halogen ketones on alkyl sulphides." By Samuel Smiles.

It has been found that certain α-halogen-substituted ketones interact with alkyl sulphides forming the halides of sulphine bases. The reaction is by no means general, for bromodiphenacyl,

$$C_6H_5\cdot CO\cdot CHBr\cdot CH_2\cdot CO\cdot C_6H_5,$$

α-bromocamphor, and certain other ketones do not act in this manner. Further, the activity of the bromine cannot be entirely due to the proximity of an acid radicle to the $CH_2\cdot Br$ group, for phenylbromomethylsulphone, $CH_2Br\cdot SO_2\cdot C_6H_5$, is without action on the alkyl sulphides. This behaviour of the α-halogen ketones is interesting when compared with that of the α-halogen-substituted acids which also contain the group $CH_2Br\cdot CO$, and react in a similar manner.

Monochloroacetone and methyl sulphide yield *acetonyldimethylsulphine chloride*, $(CH_3)_2SBr\cdot CH_2\cdot CO\cdot CH_3$, a colourless, uncrystallisable syrup which is very soluble in water; the *platinichloride* consists of pale yellow needles melting at 185°—186°.

ω-Bromoacetophenone and methyl sulphide unite to give a theoretical yield of *dimethylphenacylsulphine bromide*, $(CH_3)_2SBr\cdot CH_2\cdot CO\cdot C_6H_5$, which forms long, colourless needles, melting at 148°; it is soluble in hot water or alcohol, but very sparingly so in acetone. The *hydroxide* crystallises from chloroform in colourless leaflets which melt at 59—60°; it dissolves readily in water, giving strongly alkaline solutions. The *platinichloride* is thrown down from the aqueous solution of the chloride as a pale buff-coloured precipitate which, when pure, melts at 196—197° with decomposition. On mixing saturated alcoholic

solutions of picric acid and the bromide, the *picrate* is precipitated in sparingly soluble needles (m. p. 151—152°). The *dichromate* is insoluble in water and melts at 168—169°.

Diethylphenacylsulphine bromide forms colourless needles (m. p. 88—89°) which are very soluble in water and alcohol, but sparingly so in acetone and ethyl acetate; the *platinichloride*, a pale buff-coloured powder insoluble in most organic media, melts at 146—147° with decomposition. The *picrate* crystallises from hot alcohol in the form of bright yellow needles and melts at 125—126°. *Diamylphenacylsulphine bromide* is a colourless, crystalline substance which is soluble in water or alcohol and melts at 60—61°; the *platinichloride*, melting at 138—139°, is soluble in warm ethyl acetate. Dimethyl sulphide and bromodeoxybenzoin give *dimethyldesylsulphine bromide*,

$$(CH_3)_2S{\cdot}CHBr(C_6H_5){\cdot}CO{\cdot}C_6H_5;$$

this substance crystallises from warm ethyl acetate in colourless prisms which melt and decompose at 110°; the *platinichloride* dissolves in warm acetone and crystallises therefrom in buff-coloured needles which melt at 162°; the *picrate* forms yellow needles melting at 190°. (For other desyl derivatives, compare *Trans.*, 1900, **77**, 1178.)

49. "Pinene *iso*nitrosocyanide and its derivatives." By William Augustus Tilden and Harry Burrows.

A brief description of the cyanide and some of its reactions has been given in the "Preliminary notice of some new derivatives of pinene and other terpenes" by the same authors (*Proc.*, 1902, **18**, 161).

Pinene *iso*nitrosocyanide is shown to be a nitrile from which has been obtained, by the action of strong sulphuric acid, an amide of corresponding constitution. Pinene *iso*nitrosocarboxylamide,

$$C_{10}H_{15}(:NOH){\cdot}CO{\cdot}NH_2,$$

forms prisms which melt at 220°. It yields a methyl ether, which forms large, colourless prisms melting at 145° and a benzoyl derivative melting at 197°.

Pinene *iso*nitrosocarboxylic acid, corresponding with the amide, has not been obtained, but hydrolysis with hydrochloric acid yields an oily acid volatile in steam, which is probably the ketonic acid,

$$O{:}C_{10}H_{15}{\cdot}CO_2H.$$

By the continued action of sulphuric acid on the amide, an isomeric change is induced, the product having the properties of the lactam in which the oxime group, C:N·OH, has been converted into a carbonyl group, while an imino-group enters into the ring, thus: –CO·NH–.

From this compound, by boiling with caustic potash, the corresponding acid has been obtained. The amide crystallises in prisms, which

melt at 209° and contain 1 molecule of water of crystallisation. The acid also contains water of crystallisation and melts at 220°.

The silver and other salts of this acid have been prepared and analysed.

When heated with hydrochloric acid, the acid is converted into an amino-acid, which forms a stable, crystalline hydrochloride. In the formation of this compound, it is believed that the ring is opened and, by the assumption of the elements of water, the group –CO·NH– is converted into $-CO_2H$ and NH_2–.

50. "Some interactions of metallic cyanides with organic bases." By Robert de Jersey Fleming Struthers.

Phenylhydrazine heated with mercuric cyanide effervesces and deposits reduced mercury. This result might be indicated by the following obvious and simple equation: $HgC_2N_2 + C_6H_5\cdot NH\cdot NH_2 = Hg + 2HCN + N_2 + C_6H_6$, but in reality the reaction is complicated by the formation of the intermediate compound $HgC_2N_2,2C_6H_5\cdot NH\cdot NH_2$. This substance is a white, lustrous, crystalline solid sparingly soluble in water or alcohol; it melts and decomposes with effervescence at about 110° according to the equation: $3(HgC_2N_2,2C_6H_5\cdot NH\cdot NH_2) = 3Hg + 6HCN + 4N_2 + 4C_6H_6 + NH_3 + C_6H_5\cdot NH_2 + C_6H_5\cdot NH\cdot NH_2$.

Phenylhydrazine, when heated with cuprous cyanide, effervesces, but in other respects the action is different from that which obtains in the case of the mercury compound. An intermediate compound, $CuCN,C_6H_5\cdot NH\cdot NH_2$, was isolated in the form of brilliant scales with a silvery metallic lustre. This substance becomes rapidly discoloured at the ordinary temperature, evolves nitrogen, and ultimately acquires a deep coppery lustre. This evolution of gas was proved to be due not to spontaneous decomposition, but to an action of atmospheric oxygen.

When heated to a somewhat higher temperature than that required for the mercury salt, the copper derivative decomposes, thus: $2CuCN,C_6H_5\cdot NH\cdot NH_2 = 2CuCN + NH_3 + N_2 + C_6H_6 + C_6H_5\cdot NH_2$.

From the above reaction, it seemed possible that cuprous cyanide might exert a catalytic action on phenylhydrazine. This proved to be the case, quite a small quantity of the cyanide under proper conditions of temperature sufficing to liberate nearly the theoretical yield of nitrogen from a large excess of phenylhydrazine, the actual amount being some thirty times as much as would have been the case had there been no catalysis. The action is probably due to the alternate decomposition and regeneration of the compound $CuCN,C_6H_5\cdot NH\cdot NH_2$.

The cyanides of mercury, copper, and silver were also found to form definite additive compounds with pyridine, aniline, quinoline, and other similar bases.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

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ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Métropole, at 6.30 for 7 o'clock, on **Wednesday, March 29th, 1905** (the day fixed for the Annual General Meeting).

The price of the tickets will be One Guinea each, including wine.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, addressed and made payable to the Assistant Secretary, Chemical Society, Burlington House, London, W.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society for the election of Officers and other business will be held on **Wednesday, March 29th, 1905, at half-past four** o'clock in the afternoon.

At the next Ordinary Meeting, on **Thursday**, April **6th**, 1905, at **8** p.m., the following papers will be communicated:

"The basic properties of oxygen at low temperatures. Additive compounds of the halogens with organic substances containing oxygen." By D. McIntosh.

"Note on the interaction of metallic cyanides and organic halides." By N. V. Sidgwick.

"The chemical dynamics of the reactions between sodium thiosulphate and organic halogen compounds. Part II. Halogen substituted acetates." By A. Slator.

"The chemical kinetics of reactions with inverse reactions. The decomposition of dimethylcarbamide." By C. E. Fawsitt.

"The tautomerism of acetyl thiocyanate." By A. E. Dixon and J. Hawthorne.

"A method of determining the specific gravity of soluble salts by displacement in their own mother liquor, and its application in the case of the alkaline halides." By J. Y. Buchanan.

"The combination of mercaptans with unsaturated ketonic compounds." By S. Ruhemann.

"A new formation of acetylcamphor." By M. O. Forster and Miss H. M. Judd.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 293.

Wednesday, March 29th, 1905. Annual General Meeting. Professor W. A. TILDEN, D.Sc., F.R.S., President, in the Chair.

Dr. A. E. H. TUTTON and Mr. A. G. BLOXAM were appointed Scrutators, and the Ballot was opened for the election of Officers and Council for the ensuing year. The President then presented the Report on the state of the Society during the past twelve months.

Mr. W. J. SELL moved the adoption of the Report; this was seconded, and carried unanimously.

REPORT OF THE COUNCIL.

THE Council are glad to be in the position to report that the Society continues to flourish, and that, as measured by the number of papers read, its activity has exceeded that of any previous year.

On December 31st, 1903, the number of Fellows was 2,700. During 1904, 128 Fellows were elected, and 5 reinstated, making a gross total of 2,833. The Society has lost 28 Fellows by death; 37 have resigned; the elections of 4 have become void; 52 have been removed for non-payment of subscriptions, and 1 Fellow has with-

drawn. The total number of Fellows, therefore, on December 31st, 1904, was 2,711.

The names of the Fellows who have died are :

A. H. Allen.
F. E. Allhusen.
J. Barclay.
Sir I. L. Bell.
F. B. Benger.
C. Beringer.
H. N. Bilimoria.
W. Chattaway.
P. L. Dey.
T. H. Dodd.
W. H. Dodd.
R. E. Doran.
W. Francis.
A. Gibson.
C. G. Grenfell.
H. Grimshaw.
G. Howsam.
T. Isherwood.
J. Jackson.
A. Kitchin.
J. Mason.
D. Munro.
T. A. Pooley.
H. St. John.
C. J. Sawer.
W. H. Stanger.
R. M. W. Swan.
A. W. Williamson.

The following Fellows have resigned :

G. Ansdell.
J. F. Ballard.
J. Bardsley.
H. H. Barker.
G. E. Battle.
J. Baynes.
J. Bottomley.
G. W. Burman.
W. F. Butcher.
J. Caley.
H. M. Chapman.
T. A. Dickson.
E. Dowzard.
J. Edmunds.
T. A. Ellwood.
F. A. Gatty.
H. Gordon.
G. M. Gregory.
H. E. Haddon.
W. Hampton.
E. C. Ibbotson.
A. W. D. Leahy.
A. E. McKenzie.
T. R. Marshall.
W. Marshall.
C. A. Mitchell.
C. S. Purcell.
A. Sandford.
W. Sessions.
M. J. Sheridan.
W. Taverner.
G. Trench.
H. F. Waller.
A. W. Warrington.
A. L. White.
H. F. A. Wigley.
B. Winstone.

Among the Fellows removed by death, the Society mourns the loss of Prof. Alexander W. Williamson, who twice filled the office of President, and to whose initiative the publication of the *Abstracts* was largely due.

The number of Honorary and Foreign Members at the date of the last Annual General Meeting was 30. Six names were added to the list by the election on May 18th, 1904, of Prof. A. H. Becquerel, Prof. C. A. Lobry de Bruyn, Prof. F. W. Clarke, Madame M. Curie, Prof. C. Liebermann, and Prof. E. W. Morley. The Society has to lament the death of one of the newly elected Members, Prof. C. A. Lobry de Bruyn, on July 23rd, 1904. The number of Honorary and Foreign Members, therefore, is 35.

During the year 1904, 215 scientific communications have been made to the Society, 188 of which have already been published in the *Transactions*, and abstracts of all have appeared in the *Proceedings*.

The volume of *Transactions* for 1904 contains 175 memoirs, occupying 1,761 pages, whilst that for the preceding year contains 142 memoirs, which occupy 1,490 pages.

The *Journal* for 1904 contains also 4,617 abstracts of papers published mainly in foreign journals, which extend to 1,920 pages, whilst the abstracts for 1903 numbered 3,882 and occupied 1,640 pages.

The abstracts for 1904 may be classified as follows:

Part I.

	Pages.	No. of Abstracts.
Organic Chemistry	1,072	1,968

Part II.

General and Physical Chemistry.....		606
Inorganic Chemistry.....		541
Mineralogical Chemistry		132
Physiological Chemistry		501
Chemistry of Vegetable Physiology and Agriculture		311
Analytical Chemistry		558
	848	2,649
Total in Parts I. and II.	1,920	4,617

Owing to the great increase in the number of papers abstracted, it has become necessary to add to the editorial staff. Dr. C. H. Desch has been appointed Assistant Sub-editor, with the object of taking part in the preparation of abstracts for the press, and of relieving Mr. Greenaway of a portion of the clerical work.

Although an award of the Faraday Medal was made in 1895, fifteen years have elapsed since the delivery of the last Faraday Lecture. On April 19th, 1904, the Lecture was delivered by Professor Ostwald, in the lecture theatre of the Royal Institution, the use of which had been kindly granted by the Managers for the occasion. The subject of the Lecture was "Elements and Compounds."

The Wislicenus Memorial Lecture was delivered by Prof. W. H. Perkin on January 25th of the present year.

On the occasion of the celebration of the Jubilee of the Doctorate of

Sir Henry E. Roscoe, a Past President of the Society, on April 22nd, 1904, the Council welcomed the opportunity of sending an address of congratulation to him.

Proposals have been received from the Chemical, Metallurgical, and Mining Society of South Africa, and from the American Chemical Society, for a reciprocal exchange of Journals for members of each of these Societies and of the Chemical Society at a rate just sufficient to cover the cost of printing, addressing, and postage. After careful consideration, the Council were unable to accede to the proposals, as the effect on the finances of the Society could not be estimated, and a limit could not be set to the number of Societies which might seek the benefit of a similar exchange of Journals.

The question of co-operation in the preparation of Abstracts in English has been raised afresh by the American Chemical Society by the appointment of a committee to confer with the Chemical Society on this important subject. The Council have reappointed the Committee which discussed the possibility of co-operation in 1899, and await the proposals of the American Committee with every desire to consider their practicability.

Acting on the suggestion made in the Presidential address at the last Annual General Meeting, the Council have arranged for the preparation and publication of a series of Reports on the advance made each year in chemistry. These reports will be issued early in each year, and it is hoped that they will prove to be of value not only to the Fellows, but to students of chemistry generally.

Obituary notices of several deceased Past Presidents have not as yet been published. These notices have now been received and are in type. Among them is included an obituary notice of Sir Edward Frankland, as the Council have been unable to obtain the manuscript of the Memorial Lecture, delivered on October 31st, 1901.

A further increase in the use of the Library has to be recorded, 1,057 books being borrowed during 1904, as against 991 during the previous year. The additions to the Library comprise 119 books, of which 67 were presented, 296 volumes of periodicals, and 52 pamphlets, as against 126 books, 271 volumes of periodicals, and 43 pamphlets last year. An alteration in the wording of Library Rule IV. has been made to enable new books to be borrowed at an earlier date than formerly.

The Society has been the fortunate recipient of the eudiometer used by the late Sir Edward Frankland in the analysis of ethyl in 1849, presented by Professor Frankland; of a bronze medal of Roger Bacon, presented by Mr. Oscar Guttmann; and of an engraving of Berzelius, presented by Professor Retzius, of Stockholm.

A special Committee was appointed last June to revise the Bye-

laws, and reported in due course to the Council. The revised Bye-laws were submitted by the Council to the Society for consideration at an Extraordinary General Meeting on February 8th, but failed to secure acceptance, being referred back for further consideration.

A memorial, bearing the signatures of nineteen women engaged in chemical work, praying for the admission of women to the Fellowship of the Society, has been under consideration. The Council were advised that "married women are not eligible for election as Fellows of the Society; that it is extremely doubtful whether the Charter admits of the election of unmarried women as Fellows; that it would not be wise to elect even unmarried women without first applying for a supplemental Charter; and that the election of women as Associates would be legal after a modification of the Bye-laws expressly authorising their election." An alteration in Bye-law III. extending the privileges of the Associateship to women accordingly formed one of the changes in the Bye-laws recently proposed by the Council.

The third Report of the Joint International Committee on Atomic Weights, with its revised table of atomic weights, has been issued to the Fellows in the *Proceedings*.

Grants amounting in all to £215 have been made during the year from the Research Fund, and £26 16*s*. 6*d*. has been returned. Of the papers published in the *Transactions* during 1904, thirty-two were contributed by authors to whom grants had been made from the Research Fund.

The total income of the Society for the year 1904 was £6,700 5*s*. 8*d*. and the expenditure £5,982 14*s*. 6*d*.; in 1903, these were £6,817 19*s*. 7*d*. and £5,926 18*s*. 3*d*. respectively, so that whilst the income has fallen by £117 13*s*. 11*d*., the expenditure has risen by £55 16*s*. 3*d*. A glance at the balance sheet for 1903, however, shows receipts amounting to £257 which cannot be regarded truly as income from normal sources; in 1904 only £5 was so received. Allowing for these items, the income for 1904 shows an increase over that of 1903 of £134 6*s*. 1*d*.

The Treasurer's chief anxiety is due to the ever-increasing size of the *Journal* and the corresponding increase in cost. Both exceed those of 1903, the size by about 17 per cent. and the cost by about 10 per cent., the excess due to printing alone in 1904 amounting to £280 12*s*. 1*d*., whilst the total increase in cost reaches the large sum of £365 6*s*. 11*d*. Part of this is due to the fact that the January number for 1904 contained a double set of Abstracts, thus leading to an increase both in Abstractors' fees and in printing, these two items really representing thirteen months instead of twelve. As pointed out by the President on resigning the Treasurership two years ago, the steady increase in the

size and cost of the *Journal* seems to render it inevitable "that, in the "near future, some more stringent regulations both as to the state of "the manuscript and the dimensions of the papers will have to be "imposed" if the Society is to carry on its work of publication efficiently. In addition to the cost of the *Journal*, there is in the present accounts a sum of £237 6*s.* 0*d.* for the printing of Vol. IV, Part 1 (Authors) of the Collective Index (1893—1902). On the other hand, there has been a saving of £42 14*s.* 5*d.* in the cost of the *Proceedings*. The Library has cost less by the sum of £150 13*s.* 3*d.*, and the general administrative expenses, which in 1903 were abnormally high, owing to special circumstances, have fallen from £1,138 5*s.* 5*d.* to £893 1*s.* 0*d.*, a saving of £245 4*s.* 5*d.*, notwithstanding the cost of introducing house telephones and also connecting the Society with the Post Office system.

The Treasurer reports that the new system of keeping the Society's accounts has been in full working order for two years and has been found most satisfactory in every way.

The Council desire to place on record their appreciation of the valuable services rendered to the Society by Professor Wynne, and an expression of their regret that his removal from London obliges him to relinquish the office of Senior Secretary. By placing him among the Vice-Presidents, it is hoped that the Society may continue to receive the advantage of his experienced co-operation in the work of the Council.

The Treasurer made a statement as to the Society's income and expenditure during the past Session, and proposed a vote of thanks to the Auditors, which was seconded by Dr. L. T. Thorne, carried unanimously, and acknowledged by Mr. E. Grant Hooper.

The President then delivered his address, in which, after recapitulating the events connected with the Society which had occurred during the past year, he gave an exposition of his researches on the relation of specific heat to atomic weight in elements and compounds, the results of which led to the following conclusions.

1. The influence of temperature on the specific heats of many elements and compounds is much greater than was formerly supposed.

2. There appears to be no one condition or set of conditions under which the law of Dulong and Petit is true of all the elements.

3. The nearest approach to a constant available for practical purposes is found by taking the mean specific heats of metals between the freezing and boiling points of water, recognising glucinum, boron, carbon, and silicon as exceptions, together with hydrogen, oxygen, nitrogen, and perhaps chlorine in the solid form.

It is possible that the atomic heats of elements in the gaseous state

may be equal, direct experiment on the gases having led to the value 2·4 for hydrogen, 2·5 to 2·7 for oxygen, and 2·6 for carbon (in carbon dioxide).

4. The independence of each atom in an element or compound must be regarded as a fact of the utmost importance from the point of view of theory. That the molecular heat of a compound is the sum of the atomic heats of all the elements present is in harmony with the results of observations on other additive properties, such as specific volume and specific refraction. Such independence suggests the idea that chemical combination results from the mechanical fitting together of atoms, so that a section through a mass would exhibit, if the atoms were visible, a certain tactical arrangement probably corresponding with the closest approximation possible under prevailing conditions. It has yet to be shown that chemical combination results, *in all cases*, from the existence of electric charges resident on the atoms or in electrons associated with them. The molecules of carbon compounds, especially, may be regarded as being probably formed by the adjustment of the constituent atoms to one another in respect to space, and it is noteworthy that the liquid binary compounds of carbon, the hydrides, chlorides, and oxides, are not electrolytes, and no case is known of the electro-deposition of carbon from such compounds in the elemental form.

Professor RAPHAEL MELDOLA proposed a vote of thanks to the President, coupled with the request that he would allow the Address to be printed in the *Transactions*. Professor G. CAREY FOSTER seconded the motion, which was carried by acclamation, and acknowledged by the President.

Professor H. MCLEOD proposed a vote of thanks to the Treasurer, Secretaries, Foreign Secretary, and Council for their services during the past year. This was seconded by Dr. J. A. VOELCKER, and unanimously adopted. Professor W. P. WYNNE responded.

The Scrutators then presented their Report to the President, who declared the following to have been duly elected as Officers and Council for the ensuing year.

President: Raphael Meldola, F.R.S.

Vice-Presidents who have filled the office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; A. Vernon Harcourt, M.A., D.C.L., F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; W. H. Perkin, Ph.D., LL.D., F.R.S.; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; Sir

Henry E. Roscoe, LL.D., F.R.S.; W. J. Russell, Ph.D., F.R.S.; T. E. Thorpe, C.B., LL.D., F.R.S.; W. A. Tilden, D.Sc., F.R.S.

Vice-Presidents: Horace T. Brown, LL.D., F.R.S.; Harold B. Dixon, M.A., F.R.S.; Wyndham R. Dunstan, M.A., LL.D., F.R.S.; David Howard; A. Smithells, B.Sc., F.R.S.; W. P. Wynne, D.Sc., F.R.S.

Secretaries: M. O. Forster, D.Sc., Ph.D.; A. W. Crossley, D.Sc., Ph.D.

Foreign Secretary: Sir W. Ramsay, K.C.B., LL.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Ordinary Members of Council: Edward C. C. Baly; Augustus E. Dixon, M.D.; J. J. Dobbie, M.A., D.Sc., F.R.S.; Bernard Dyer, D.Sc.; Alfred D. Hall, M.A.; A. Lapworth, D.Sc.; J. E. Marsh, M.A.; E. J. Mills, D.Sc., F.R.S.; G. T. Moody, D.Sc.; W. J. Sell, M.A., F.R.S.; J. M. Thomson, LL.D., F.R.S.; J. Wade, D.Sc.

ANNIVERSARY DINNER.

The Anniversary Dinner of the Society took place at the Whitehall Rooms on Wednesday, March 29th, at 7 p.m., when the following Fellows and their guests dined together:

Armit, Dr.
Attfield, Prof. J., F.R.S.
Beadle, Mr. C.
Beale, Mr. W. P., K.C.
Beilby, Mr. G.
Bevan, Mr. E. J., *President of the Society of Public Analysts.*
Bodmer, Mr. R.
Borns, Dr. H.
Bousfield, Dr. W., *Master of the Clothworkers' Company.*
Bowley, Mr. J. J.
Brown, Dr. H. T., F.R.S., *Vice-President.*
Browne, Sir J. Crichton-, F.R.S., *Treasurer of the Royal Institution.*
Callendar, Prof. H. L., F.R.S.
Cannon, Mr. M. J.
Carpmael, Mr. A.
Carr, Mr. S. E., *Assistant Secretary.*
Chapman, Mr. A. C.
Church, Sir W. S., Bart., K.C.B., *President of the Royal College of Physicians.*
Conrad, Mr. J. C.
Cottrill, Mr. F.
Cowley, Mr. G.
Crossley, Prof. A. W., *Hon. Secretary-elect.*
Daily Telegraph, The.
Dakin, Dr. H. D.
Day, Mr. A. B., *Master of the Society of Apothecaries.*
Dickins, Mr. F. V., C.B.
Divers, Prof. E., F.R.S., *Deputy-President of the Society of Chemical Industry.*
Dodds, Mr. J. M.
Dunstan, Prof. W. R., F.R.S., *Vice-President.*
Dyer, Dr. B.
Elliott, Sir T. H., K.C.B., *Secretary of the Board of Agriculture.*
Fairley, Mr. T.
Farmer, Prof. J. B., F.R.S.
Fenton, Mr. H. J. H., F.R.S.
Formoy, Mr. J. A.
Forster, Dr. M. O., *Hon. Secretary.*
Garwood, Prof. E. J.
Gibbons, Mr. W. M.
Glazebrook, Dr. R. T., F.R.S., *Director of the National Physical Laboratory.*
Gordon, Mr. J. G.
Gowland, Prof. W., F.S.A.
Greenaway, Mr. A. J., *Sub-Editor.*
Groves, Mr. C. E., F.R.S.
Guttmann, Mr. O.
Haggarth, Mr. R. N.
Haldane, The Rt. Hon. R. B., K.C., M.P.
Hall, Mr. S.
Harden, Dr. A.

Henry, Dr. T. A.
Hewitt, Dr. J. T.
Heycock, Mr. C. T., F.R.S.
Hicks, Dr. W. M., F.R.S., *Principal, University College, Sheffield.*
Hill, Mr. C. A.
Hills, Mr. J. S.
Hodgkinson, Prof. W. R.
Holloway, Mr. G. T.
Hooper, Mr. E. G.
Howard, Mr. T.
Jackson, Mr. H.
Johnston, Mr. J. H.
Jones, Dr. H. O.
Jones, Mr. O. T.
Judd, Prof. J. W., C.B., F.R.S., *Dean of the Royal College of Science.*
Kemp, Mr. W. J.
Knowles, Mr. J.
Kohn, Dr. C. A.
Larmor, Prof. J., F.R.S., *Secretary of the Royal Society.*
Leah, Mr. S. D., I.S.O.
Lewkowitsch, Dr. J.
Lockyer, Sir J. Norman, K.C.B., F.R.S., *Director of the Solar Physics Observatory.*
Lowry, Dr. T. M.
Lymn, Mr. A.
MacEwan, Mr. P.
Mason, Mr. H.
Matthews, Dr. F. E.
Meldola, Prof. R., F.R.S., *President-elect.*
Messel, Dr. R.
Millington, Mr. J. P.
Mills, Mr. J. P.
Mohr, Dr. B.
Mond, Mr. E. S.
Mondy, Mr. E. F.
Moody, Dr. G. T.
Moore, Mr. J. E. S.
Morgan, Dr. G. T., *Editor.*
Morning Post, The.
Morrell, Dr. R. S.
Moss, Mr. C. C. B.
Müller, Dr. H., F.R.S., *Past President.*
Newth, Mr. G. S.
Newton, Mr. A. W.
Ogilvie, Mr. F. G., *Principal Assistant-Secretary, Technology and Higher Education in Science and Art, Board of Education.*
Orton, Prof. K. J. P.
Page, Mr. F. J. M.
Pam, Mr. A.
Penton, Col. A. P., R.A., C.B.
Perkin, Dr. W. H., F.R.S., *Past President.*
Perry, Prof. J., F.R.S.
Philip, Dr. J. C.
Ping, Mr. W.
Power, Dr. F. B.
Preece, Mr. A., C.E.
Press Association, The.
Pye-Smith, Dr. P. H., F.R.S., *Vice-Chancellor of the University of London.*
Ramsay, Sir W., K.C.B., F.R.S., *Foreign Secretary.*
Rastab, Mr. R. H.
Rayleigh, The Rt. Hon. Lord, O.M., F.R.S.
Reynolds, Prof. J. E., F.R.S., *Past President.*
Robinson, Mr. R. A., *President of the Pharmaceutical Society.*
Scott, Dr. A., F.R.S., *Treasurer.*
Sell, Mr. W. J., F.R.S.
Spielmann, Mr. P. E.
Standard, The.
Stevenson, Mr. H. E.
Stevenson, Mr J.
Sueur, Dr. H. R. Le.
Swinburne, Mr. J.
Teed, Dr. F. L.
Thomson, Prof. J. M., F.R.S.
Thorne, Dr. L. T.
Thorpe, Dr. J. F.
Thorpe, Prof. T. E., C.B., F.R.S., *Past President.*
Thorpe, Mr. W. B.
Tilden, Prof. W. A., V.P.R.S., *President.*
Tilley, Mr. J. W.
Tilley, Mr. V. J.
Times, The.
Tunnicliffe, Mr. J. E.
Tyrer, Mr. T.
Voelcker, Dr. J. A.
Wade, Dr. J.
Watt, Sir George, C.I.E.
Webb, Sir Aston, R.A.
Wrampelmeier, Mr. T. J.
Wynne, Prof. W. P., F.R.S., *Hon. Secretary and Vice-President-elect.*
Young, Mr. A.

The following Toasts were proposed :—

By THE PRESIDENT.

1. His Most Gracious Majesty the King.
2. Her Majesty the Queen Alexandra, their Royal Highnesses the Prince and Princess of Wales, and the other Members of the Royal Family.

By Sir WILLIAM S. CHURCH, Bart., K.C.B.,

President of the Royal College of Physicians.

3. Prosperity to the Chemical Society, coupled with the name of *The President*.

By Professor RAPHAEL MELDOLA, F.R.S.,

President-Elect of the Chemical Society.

4. Scientific Institutions, coupled with the names of Professor JOSEPH LARMOR, D.Sc., F.R.S., *Secretary of the Royal Society*, and Dr. R. T. GLAZEBROOK, F.R.S., *Director of the National Physical Laboratory.*

By Sir WILLIAM RAMSAY, K.C.B., LL.D., F.R.S.,

Foreign Secretary of the Chemical Society.

5. The Guests, coupled with the names of The Right Honourable R. B. HALDANE, K.C., M.P., and Professor JOHN PERRY, D.Sc., F.R.S.

The PRESIDENT, in proposing the toast of "His Most Gracious Majesty the King," said he did not intend to question the loyalty and the good sense of the Fellows of the Chemical Society and their guests by making a speech.

The toast was drunk with enthusiasm.

The PRESIDENT next proposed the toast of "Her Majesty the Queen Alexandra, their Royal Highnesses the Prince and Princess of Wales, and the other members of the Royal Family." No words, he said, were necessary to recommend the toast, but it would be appropriate to say on that occasion that they had all watched with interest the progress of the voyage undertaken by Her Majesty and

her Royal daughters, and they trusted that they would return in due time from the sunny seas of the South refreshed and invigorated by the sea breezes.

The toast having been duly honoured,

Sir William S. Church, K.C.B., in proposing the toast of "Prosperity to the Chemical Society," said he did not know what may have been passing in the President's mind at the time when he (the speaker) was thought to be a fit person to propose the toast. It may have been that the President's memory went back to the time when few, excepting those of the medical profession, had any acquaintance with the chemistry of their day, and when few took any interest in the study of the phenomena of nature. When they looked round that assembly there could be no doubt of the position chemistry had taken in these days. That Society was one of the oldest of the Societies in the Kingdom, dealing with different branches of science. It was founded more than sixty years ago—in 1841—and as long ago as 1848 it received its charter. Just consider what had taken place since those days. At that time the Society numbered only 300 members. He did not know the present numbers, but what he did know was that the advances made in Chemical Science and the advantages to the world derived therefrom could not possibly be over-estimated. In that advance their Society had played a very large and prominent part. When one considered the extraordinary advance of knowledge which had taken place since 1841—and how the science of chemistry was now connected and inter-connected with all the ordinary necessaries of life, it was remarkable to consider the difference between the position of Chemical Science in this country in 1841 and to-day. Out of their Society—which had for its object the advancement and the distribution of knowledge, and the publication of special researches in its own branch of science—had grown other societies—those which dealt with the application of chemistry to the arts and necessaries of life. The principal societies were the Society of Chemical Industry, the Institute of Chemistry, the Society of Public Analysts, and the Pharmaceutical Society. He did not know whether their Society had any titular god or goddess upon its sigillum or seal, but it must have been a difficult matter to make a choice, because they might have chosen Ceres as illustrating the peace and prosperity which had accrued to the country through the advances of chemistry; or, on the other hand, he feared they could equally have chosen Bellona when they considered how much chemistry had done in the promotion of arms. But neither of these objects had been the aim of their Society. Its true object had been the advancement of knowledge by searching out the forces

and secrets of nature. What higher aim could a Society have? In those few words he gave them the toast of Prosperity to the Chemical Society.

The PRESIDENT, in replying, said he hoped they would agree with him that it was quite a proper thing to do to invite Sir Wm. Church, President of the Royal College of Physicians, to propose the toast, remembering that if chemistry did not spring entirely out of medicine, at any rate, the two branches of applied science had always been closely associated in the past. He was glad Sir William Church reminded them of the very important principle that experiment was the most secure basis of progress in all natural knowledge, which he thought was not always borne in mind by all his chemical friends. Some of them were ready to invent new hypotheses for explaining everything that occurred day by day, forgetting that every hypothesis, no matter how attractive, would sooner or later be superseded by something more comprehensive, based upon fresh knowledge. They had the honour of entertaining that evening one of the most brilliant exponents of the application of that principle—of course, he need scarcely say he referred to Lord Rayleigh. Experiment was the best foundation—and he was looking to his friend, Sir Wm. Ramsay, to fully agree with him.

Dr. Johnson once said that when a man knew he was going to be hanged in a fortnight, it tended greatly to concentrate his thoughts. They would, therefore, readily understand his own position during the past fortnight. That festival was the occasion of what might be called the apotheosis of the retiring President. He should wake up in the morning to find that he was no longer President of the Chemical Society, but one that had been President, and no matter what might happen in years to come, that great source of pride and satisfaction could not be taken from him. Many other changes also came about at the same time, and he could not help referring again with great regret to the change which deprived them of the help and the association of their friend Professor Wynne, the Senior Secretary. The Society owed a great deal to its officers, and especially to the Secretaries, and in welcoming Professor Crossley to fill the vacant post, they might feel confident that the share of the Society's affairs which fell to his lot would not suffer at his hands. The Society had now passed its first youth, having celebrated its Jubilee fourteen years ago. Of course, as Sir William Church had reminded them, many changes had taken place, not only in the extent of their knowledge but in the fundamental nature of their ideas with regard to all chemical questions since the foundation of the Society. Occasions like that must revive very vividly in the minds of some of the past presidents—several of

whom he saw present that evening—the successive changes that had gone on since they held office. In the past year they had lost, in the person of the late Professor Williamson, a past president, one of those great men who had helped to lay the foundations of their science and of whom so few now remained. The Chemical Society had grown rapidly, but more particularly during the last ten or twelve years. He had been an officer of the Society for six years, and even in his time the membership had increased, roughly, about 100 per annum. When they entered upon the occupancy of the rooms which were allotted to them by the Government in Burlington House, the members in their ranks did not exceed about one-third of what they were now. That was thirty years ago. But now they were beginning to feel like some of those crustaceans, who periodically found their shells too tight. They wriggled out of it somehow and then grew a new shell better fitted to their enlarged proportions. They were not yet in a position to do that, but certainly the Society began to find its present quarters rather a tight fit. It seemed to him that a few informal gatherings for conversation, sometimes, perhaps, for demonstration and experiment, would be of great advantage to them; but he confessed he had never been able to see how it could be accomplished in their present quarters; and he could not help feeling some sentiment of envy toward their friends, the German Chemical Society, who occupied the palatial Hofmann-Haus in Berlin. They could hardly hope yet to secure quarters comparable with those. Nevertheless, the idea was fixed in his mind that informal gatherings might be useful in removing misunderstandings that sometimes would exist —notwithstanding the efforts of the Council and the Publication Committee—such as arose when authors of papers were not satisfied with the number of pages assigned to their important contributions. Questions of that kind arose, and occasioned now and then little heart-burnings—not very much—but even that little could probably be removed if they had opportunities of meeting together to talk—and to smoke, if they liked—and of getting to understand and to know one another rather better. The Fellows of the Chemical Society could really not be reproached for indulging too freely in conviviality. They dined only once in two years—and he was told that some of them drank beer after the ordinary scientific meetings—which, no doubt, occasionally were conducive to thirst.. He was confident that the Society would continue to grow and prosper. It was necessary that it should grow, if they were to continue the development and publication of their splendid JOURNAL. He would say fearlessly that their JOURNAL—

if not in bulk, certainly in quality, was equal to any scientific journal in the world—and it did, at the present time, fairly represent British chemistry. Of course, they must all go on reading French and German, but he wished some of their friends on the Continent could be induced to learn to read English—and the only way to compel them to do so was to make the JOURNAL so good that they could not afford to ignore it. All this could only be accomplished by their sticking together, by doing their scientific best, and pouring into the JOURNAL all the products of their laboratories and experimental work.

PROFESSOR RAPHAEL MELDOLA, F.R.S., proposed "Scientific Institutions." Looking at the list of institutions represented there that evening, he said, it might be confidently asserted that every one of the subjects represented by those institutions came well within the cognisance of the Fellows of the Chemical Society; and he supposed there was no branch of natural knowledge at the present time into which chemistry had not, in one way or another, inserted itself. They welcomed all co-workers in their domain. There were representatives of institutions other than those that had been mentioned, and he hoped Sir Thomas Elliott would allow the Board of Agriculture to be considered a scientific institution. Chemistry had certainly made itself felt in that department. They welcomed Professor Larmor, not only on behalf of the Society which he represented, but in his individual capacity. The great specialisation of science in modern times had taken away a great many of the communications which the Royal Society used to receive. This in no way detracted from the status or the importance of the Royal Society, but it rather spoke in favour of the active development of modern science in various directions. Professor Larmor's name stood pre-eminent in the great work of chemical science, although with regard to his own work, he (Professor Meldola) was afraid he must confess that he and many of his colleagues were not able to follow the Professor in all his abstruse flights. With regard to Dr. Glazebrook, they all knew that although a comparatively young institution, the National Physical Laboratory had amply justified its foundation. He need hardly remind those present that any institution which helped them to standardise the instruments they used, conferred an inestimable benefit upon their science and upon the work they were undertaking. Moreover, judging from a recent report of the National Physical Laboratory, much work had been done lately which might legitimately be classified as more or less chemical in character, and in welcoming the Director of that Laboratory they could only express their satisfaction that the results which had been achieved had been achieved with compara-

tively modest means, when they considered that the Government aid to the National Physical Laboratory was about one-fourth that given to the Reichsanstalt at Berlin, and one-fifth that given to the Bureau of Standards for the United States. In conclusion, he paid a tribute to the work of Sir Norman Lockyer, Lord Rayleigh, and Sir William Ramsay.

Professor Joseph Larmor, in replying, said he was glad to be greeted as an official of the parent Society, which had preserved the closest possible relations with her offspring. He believed that in this country there was a notion that much more could be achieved by the scientific workers here than in any other country in the world. Continental nations gave very extensive subsidies from public money, whereas in England it was considered that scientific men should provide their own means.

Dr. R. T. Glazebrook also responded. He said his Institution had a large field to cover, and at each point of that field they were brought into close contact with other Societies. They claimed to be a kindred institution because they had the same high aims and employed exactly the same experimental methods as those pursued by the Chemical Society. He was glad to bear witness to the great assistance given them by their chemical friends, and the impossibility of conducting much of that work without that assistance, so cordially and generously given.

Sir William Ramsay, K.C.B., next proposed "The Guests." He said he would not be so invidious as to allude to their guests by name or qualification. These details could all be found in the "Dictionary of National Biography" or in the more modest "Who's Who." They were delighted to see their friends and guests present, and hoped to see them all again on many similar occasions.

The Rt. Hon. R. B. Haldane, in responding, said he objected to be divided by a line, as Sir William Ramsay had done, from Professor Perry. If Professor Perry could, as Sir John Fisher once said, teach the differential calculus to the working classes, he (Mr. Haldane) had ventured to teach equally dubious things to the working classes. He could not call himself a chemist, but he had got a conviction that the problem which lay in front of the British nation was how to develop what he might call the grey matter of the executive brain. All the things spoken of that night represented something new in the nation, and not only something new, but something of which they would have to see a great deal more if the nation was to hold its own in these days. Science counted for more than ever it did. The West had had a rude awakening at the hands of the East. The controversies which agitated the minds of politicians were of less importance than the great question of

how to make the permanent element in politics more powerful and better than it was. He was not talking of Cabinets. They come and go, but to-day they seem to go more rapidly than ever. There was too little science in the present day, although one or two things had been done for which they were very grateful, in connection with the Navy and the Army and the Defence Committee. That was one link. If they turned to the different departments of the Government there was hardly one which did not require science, if its policy was to be an effective policy. The War Office and the Admiralty were dependent on the higher problems at the command of science. The Department of Public Health—the Local Government Board—was in the same position, and so was the Board of Trade, which brought another kind of science—that science which could only come from a very wide survey from the largest point of view of the dull subject of statistics. Wherever they turned science was needed, and yet there was not sufficient attraction to a man of high attainments to put himself at the disposition of the State. Foreign Governments held out careers far in excess of any rewards and honours which the British Government could afford. Was it impossible to see an era in which the head of the Government could have at his disposition the first intelligence and the best brains which the nation could command? While that might be a dream, it was, he thought, a dream which events were preparing them for seeing realised. If we were to hold our own we must not be behind Berlin, the United States, or the French nation. There was a policy more worthy the consideration of politicians than some policies which were taking up the time of the House of Commons, and this policy had the great advantage that it was a non-party one. He looked forward to the day when somebody would put his back into this business, that somebody would have the power of so impelling the administration of the day that it would be forced to respond to the demand of every class of the electorate, and every section of British society. Anybody who wished to attract public confidence could do worse than take up a policy of that kind, and he believed the British Treasury would open its hand. Science never stands still, and if science does not stand still, Governments cannot afford to stand still in their use of science. These were speculations which, perhaps, went beyond the moment, but he had a strong feeling that the time was very nearly, if not quite, ripe for them. They would see what was the mind of the nation on this point, and doubtless they would be subjected to the acute disappointment to which all were usually subjected when they formed great expectations. He hoped to see the position of

science raised in the next few years, and he looked to the time when brute force would count for little, and knowledge for more.

PROFESSOR PERRY also responded.

Thursday, April 6th, 1905. Professor R. MELDOLA, F.R.S., President, in the Chair.

It was proposed by Professor ARMSTRONG and seconded by Dr. LAPWORTH that the minutes of the previous meeting be taken as read. After some discussion, the President ruled that the course prescribed in Bye-law XI be followed.

Messrs. B. M. Jones, C. E. Fawsitt, A. Angel, and W. H. Ratcliffe were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

Albert Edward Andrews, 37, Oakhurst Grove, East Dulwich, S.E.
Francis George Belton, 16, Clarkson Street, Sheffield.
Edward S. H. E. Brettell-Vaughan, The Cwm, Aston-on-Clun, Salop.
Thomas Walter Firth Clark, 117, Clerkenwell Road, E.C.
Horace Finnemore, 21, Linden Mansions, Highgate, N.
John Griffiths, B.Sc., The Hollies, Upton Park, Chester.
James Henry Howgate, B.A., The Avenue, Bakewell, Derbyshire.
William Henry Leek, B.A., Elm View, Leigh, Lancashire.
Francis Grimshaw Martin, King Henry VIII School, Coventry.
Alfred Mortimer, B.A., Trinity College, Stratford-on-Avon.
Sydney Dockeray Stennitt, M.Sc., 16, Richmond Terrace, Whitchurch, Salop.
Edmund Henry Stevens, B.A., Haw House, Rothbury, Northumberland.
Harold Blythen Stevens, 225, Oxford Street, W.
Francis Henry Wall, 14, Hardman Street, Liverpool.

Of the following papers, those marked * were read :

51*. "The kinetics of chemical changes which are reversible. The decomposition of *as*-dimethylcarbamide."
By Charles Edward Fawsitt.

This investigation is a continuation of the work already published on carbamide (*Zeit. physikal. Chem.*, 1902, **41**, 601) and methylcarbamide (*Trans.*, 1904, **86**, 1581). The theory which was put forward to explain the decomposition of carbamide and methylcarbamide holds good also in the present case.

There is in every respect a very strong similarity between the decomposition of *as*-dimethylcarbamide and that of the cases already studied, and there can be no doubt that all the alkylcarbamides decompose in a similar manner.

Dimethylcarbamide decomposes on heating with acids into the corresponding ammonium salt and dimethylamine salt, the mechanism of the change corresponding with a reaction of the first order having a velocity about six times as great as that of carbamide.

*52. "A new formation of acetylcamphor."
By Martin Onslow Forster and Hilda Mary Judd.

The *imine*, $C_8H_{14}<\begin{matrix}CH\cdot CMe:NH\\ |\\ CO\end{matrix}$, obtained by the action of magnesium methyl iodide on α-cyanocamphor, crystallises from petroleum and melts at 126°; it has $[\alpha]_D$ 263·2° in chloroform, and develops an intense blue coloration with alcoholic ferric chloride. It is indifferent towards aqueous alkalis, but is resolved quantitatively by acids into acetylcamphor and ammonia. Magnesium phenyl bromide converts α-cyanocamphor into the corresponding derivative of benzoylcamphor, previously obtained by heating the enolic modification of the diketone with ammonium formate.

The *compound* $C_{12}H_{18}O$, produced when magnesium methyl iodide acts on hydroxymethylenecamphor or its α-benzoyl derivative, is a pleasant-smelling liquid which boils at 228—229° under 764 mm., and has $[\alpha]_D$ 195·0° in chloroform; it is indifferent towards phosphorus pentachloride, phenylcarbimide, hydroxylamine, and ammoniacal silver oxide, but yields camphoric acid with potassium permanganate, which it decolorises immediately. The *dibromide*, $C_{12}H_{18}OBr_2$, melts at 152—153° and has $[\alpha]_D$ 157·2° in chloroform.

The *compound* $C_{13}H_{20}O$, prepared from hydroxymethylenecamphor and magnesium ethyl iodide, boils at 236—238° under 745 mm., and has $[\alpha]_D$ 168·2; its chemical properties resemble those of the lower homologue. The *dibromide*, $C_{13}H_{20}OBr_2$, melts at 88° and has $[\alpha]_D$ 130·5°.

*53. "Preparation and properties of 1:4:5-trimethylglyoxaline."
By Hooper Albert Dickinson Jowett.

In the attempt to prepare substances having a constitution analogous to that of pilocarpine, the following compounds were isolated and characterised.

4:5-Dimethylglyoxaline, $C_5H_8N_2$, first prepared by Künne (*Ber.*, 1895, **28**, 2039), boils at 165° under 10 mm. pressure and forms a

crystalline nitrate (m. p. 180°, not 164° as stated by Künne) and a *picrate*, yellow needles (m. p. 196—197°).

1 : 4 : 5-*Trimethylglyoxaline*, $C_6H_{10}N_2$, boils at 117° under 20 mm. pressure and crystallises in needles (m. p. 46°); the crystals are soluble in all proportions in water, alcohol, or ether. The *nitrate*, $C_6H_{10}N_2,HNO_3,H_2O$, forms long needles (m. p. 46°); the *hydrochloride*, $C_6H_{10}N_2,HCl,H_2O$, forms needles which lose their water of crystallisation over sulphuric acid or at 110°; the anhydrous salt melts at 199°. The following salts were also prepared: the *aurichloride*, yellow needles (m. p. 202°); *platinichloride*, yellow crystals (m. p. 224—225°); *picrate*, yellow needles (m. p. 218°); *methiodide*, long needles (m. p. 158°).

2-*Bromo*-1 : 4 : 5-*trimethylglyoxaline*, $C_6H_9N_2Br,2H_2O$, obtained by the bromination of trimethylglyoxaline, crystallises from hot water in long, silky needles (m. p. 49°); the anhydrous base melts at 83°. The following salts were also prepared: *hydrobromide*, cubical crystals (m. p. 208°); *aurichloride*, yellow needles (m. p. 191°); *picrate*, yellow needles (m. p. 173°).

*54. "Bromomethyl heptyl ketone."
By Hooper Albert Dickinson Jowett.

In the course of some experiments made with the view of preparing the glyoxaline from methyl heptyl ketone, this ketone yielded bromomethyl heptyl ketone by the action of bromine in chloroform solution. By subsequent fractionation of the product, the *bromoketone* was isolated as a pale straw-coloured liquid boiling at 122° under 15 mm. pressure.

0·1256 gave 0·2228 CO_2 and 0·0928 H_2O. C = 48·4; H = 8·2.
0·312 „ 0·2652 AgBr. Br = 36·2.
$C_9H_{17}OBr$ requires C = 48·8; H = 7·7; Br = 36·2 per cent.

The liquid has the characteristic odour of the ketone and acts very quickly on the eyes, causing a copious flow of tears.

Attempts to condense the bromoketone with potassium phthalimide were unsuccessful.

*55. "Limonene nitrosocyanides and their derivatives."
By Frederick Peacock Leach.

It has been previously shown (*Trans.*, 1904, **85**, 931) that limonene β-nitrosochloride gives rise to a crystalline nitrosocyanide (m. p. 90—91°). The investigation has been continued with the result that both the α- and β-nitrosochlorides of limonene have been found to yield the same isomeric nitrosocyanides, the reaction between the potassium

cyanide and the nitrosochlorides being carried out at 25—30°. The nitrosocyanides are unimolecular and optically active and, therefore, analogous to the limonene nitrolamines discovered by Wallach (*Annalen*, 1889, **252**, 113).

The *α*-nitrosocyanide crystallises in prisms (m. p. 90—91°), whilst the *β*-compound crystallises in fine, woolly needles (m. p. 140—141°). These isomerides are to be regarded as having the *cis*- and *trans*-configurations, because on hydrolysis, both, by loss of carbon dioxide from their respective acids, give rise to the normal oxime of dihydrocarvone.

From the *d*- and *l*-*α*-nitrosocyanides were also obtained the benzoyl derivatives (thin plates, m. p. 108°), methyl and ethyl ethers as viscid oils, and the hydrochloride crystallising from alcohol in thin leaves (m. p. 56°).

The *d*- and *l*-benzoyl derivatives of the *β*-nitrosocyanide each crystallise from dilute alcohol in long, silky needles (m. p. 121°).

The *d*- and *l*-*α*-amides each gave a methyl ether as a viscid oil, a benzoyl derivative (m. p. 152°), and a hydrochloride (m. p. 100—101°).

The *d*- and *l*-*α*-acids each gave ammonium and silver salts, the former being finely crystalline and the latter amorphous. The *d*-methyl ester melts at 65°.

Racemic compounds.—*α*-Nitrosocyanide separates in prisms from petroleum (m. p. 81°), its benzoyl derivative melts at 96°. The *β*-nitrosocyanide forms fine needles (m. p. 159—160°) and its benzoyl derivative crystallises in needles melting at 98°.

*56. "The action of carbon monoxide on ammonia." By Herbert Jackson and Dudley Northall-Laurie.

The authors have studied the behaviour of these gases when heated together in the presence of platinum, or when subjected to electric sparks or high frequency discharges. They find that the main reaction is the formation of ammonium cyanate, which, under the conditions of the experiment, rapidly changes to carbamide. Hydrogen is produced, and some of this interacts to give water, which in its turn brings about the formation of ammonium carbonate. The amount of ammonium cyanide formed is small. Other products are obtained by prolonging the experiment, but only in quantities which are small compared with the yield of the main product, carbamide.

Discussion.

Professor E. J. Mills said the authors' experiments reminded him of some of his own carried out a number of years ago. He then found that, by passing a current of mixed carbonic oxide and ammonia gas

over strongly heated caustic potash in presence of carbon, cyanide was formed in large quantity. In fact, a potassium salt containing more than 70 per cent. of cyanide was readily produced. The carbon, of course, precluded the formation of any cyanate.

*57. "The action of acetylene on aqueous and hydrochloric acid solutions of mercuric chloride."

By John Samuel Strafford Brame.

Bilz and Mumm (*Ber.*, 1905, **37**, 4417) and Hofmann (*Ber.*, 1904, **37**, 4459) show that the white precipitate obtained when acetylene is passed into aqueous mercuric chloride is trichloromercuriacetaldehyde, $\cdot C(HgCl)_3 \cdot CHO$. The author obtained results three years ago which agree closely with those of the above and other observers, but attention is now called to the considerable differences between the determined and calculated values, the analytical results for mercury being very low, whilst those for chlorine are too high. From the reactions, however, the foregoing constitution seems to be the most reasonable one.

Berge and Reychler (*Bull. Soc. chim.*, 1897, **17**, 218) state that acetylene has no action on dilute hydrochloric acid solutions of mercuric chloride, but the author obtained a fine crystalline substance, which was afterwards found to have been described by Biginelli (*Ann. Farm. Chim.*, 1898, 16), who ascribed to it the constitution $Cl \cdot HC{:}CH \cdot HgCl$ from estimations of mercury and chlorine only. This conclusion has been confirmed by complete analysis and the compound is further described.

Biginelli states that when boiled with water the above compound yields $CH_2{:}CH \cdot HgCl$, but the author fails to obtain such a result. It is shown that the product is really trichloromercuriacetaldehyde, but a certain amount of mercurous chloride is also present, this being ascribed to the reducing action of the aldehyde liberated on the mercuric chloride.

Biginelli's statement that $C_2H_2 \cdot HgCl_2$ gives with alkalis an acetylide, $(C_2H_2)_2HgO$, cannot be confirmed, but evidence from analyses and properties shows the substance to be identical with the acetylide $3C_2Hg,H_2O$ described by Travers and Plimpton (*Trans.*, 1894, **65**, 264). Attempts are being made to prepare the anhydrous acetylide.

The first action of acetylene with mercuric chloride appears, therefore, to be one of simple combination, the additive product being then decomposed by water with the production of aldehyde and $C(HgCl)_3 \cdot CHO$.

58. "The basic properties of oxygen at low temperatures. Additive compounds of the halogens with organic substances containing oxygen." By Douglas McIntosh.

Crystalline compounds of chlorine with methyl and ethyl alcohols have been obtained at low temperatures ($-80°$), the formula of the former being probably CH_4OCl, whilst the latter has the composition C_2H_6OCl; their melting points are $-96°$ and $-88°$ respectively. Compounds of a similar type were isolated containing bromine, the methyl alcohol derivative, CH_4OBr, being a red, crystalline substance melting at $-53°$.

Methyl ether, although not yielding a solid product with chlorine at $-95°$, furnished a bromine compound, C_2H_6OBr, melting at $-68°$. Ethyl ether yielded $C_4H_{10}OCl_2$ (m. p. $-51°$) and $C_4H_{10}OBr_2$ (m. p. $-40°$).

Acetone combined with chlorine to form $C_3H_6OCl_2$ (m. p. $-53°$), whilst with bromine it gave rise to $C_3H_6OBr_2$ (m. p. $-12°$).

Ethyl acetate yielded the additive products $CH_3{\cdot}CO_2Et,Cl_2$ (m. p. $-64°$) and $CH_3{\cdot}CO_2Et,Br_2$ (m. p. $-39°$). Acetaldehyde and acetic acid also seem capable of combining additively with chlorine and bromine at low temperatures.

59. "Note on the interaction of metallic cyanides and organic halides." By Nevil Vincent Sidgwick.

It is possible to explain the formation of both nitriles and *iso*cyanides in this reaction by means of the same additive compound, and that of the most probable type, in which the addition has been to the bivalent carbon only. Such a compound, like an unsymmetrical oxime, could exist in two stereoisomeric forms, $\begin{matrix} R{\cdot}C{\cdot}I \\ \| \\ N{\cdot}M \end{matrix}$ and $\begin{matrix} R{\cdot}C{\cdot}I \\ \| \\ M{\cdot}N \end{matrix}$, where M = K, Ag, &c., and R = alkyl or acyl. The first of these would easily lose MI to give a nitrile, in accordance with Nef's view, but the second could not, as the metal and the halogen are too far apart, and it would therefore undergo the Beckmann reaction. This change brings these substituents nearer together, so that now they combine and become eliminated, leaving an *iso*cyanide:

$$\begin{matrix} R{\cdot}C{\cdot}I \\ \| \\ M{\cdot}N \end{matrix} \longrightarrow \begin{matrix} M{\cdot}C{\cdot}I \\ \| \\ R{\cdot}N \end{matrix} = \begin{matrix} C \\ \| \\ R{\cdot}N \end{matrix} + MI.$$

If this is the case, we must suppose that an alkyl iodide and potassium cyanide, or an acyl halide and silver cyanide (which yield nitriles),

give the "*syn*-haloid" form, and an alkyl iodide and silver cyanide the "*anti*-haloid."

It may also be pointed out that neither of the formulæ of hydrocyanic acid can be that of a strong acid, because if it were the alkali salts would be derived from that form, and would not be, as they are, highly hydrolysed in solution.

60. "The chemical dynamics of the reactions between sodium thiosulphate and organic halogen compounds. Part II. Halogen substituted acetates." By Arthur Slator.

Many of the halogen substituted acetates interact more readily with sodium thiosulphate than the corresponding methyl haloids. The reactions with ethyl iodoacetate and methyl, ethyl, and sodium bromo- and chloro-acetates have been investigated and shown in all cases to be bimolecular reactions. The esters are considerably more reactive than the sodium salts. The temperature quotient of the reactions with the esters was found to be in all five cases approximately 2·8; with the sodium salts, an appreciably smaller value was obtained. The reaction between ethyl bromoacetate and potassium, ammonium, barium, strontium, sodium silver, lead and sodium lead thiosulphates have been measured, and from the results obtained it is probable that the reaction is primarily connected with the S_2O_3'' ion, and that the undissociated or partially dissociated salts are relatively inactive. The velocity of reaction is proportional to the concentration of the S_2O_3'' ion, and the measurements may therefore be used to estimate such concentrations. The dissociation constant of lead thiosulphate measured in this way was found to have the value $[Pb^{\cdot\cdot}][S_2O_3'']/[PbS_2O_3] = 1{\cdot}5 \times 10^{-4}$.

61. "The tautomerism of acetyl thiocyanate." By Augustus Edward Dixon and John Hawthorne.

When acetyl thiocyanate is brought into contact with aniline at temperatures ranging from $-12°$ to about 120°, in presence of an inert solvent, such as benzene, interaction occurs spontaneously, with development of much heat, the chemical changes running concurrently on two distinct lines: (1) a change by double decomposition, in which the sulphur appears wholly in the form of thiocyanic acid, as shown by the equation $Ac{\cdot}SCN + 2PhNH_2 = Ac{\cdot}NHPh + PhNH_2,HSCN$; (2) an additive process in which the sulphur plays a thiocarbimidic part, thus: $Ac{\cdot}NCS + PhNH_2 = AcNH{\cdot}CS{\cdot}NHPh$. At 87°, one-half of the total weight of product consists of acetanilide together with aniline thiocyanate, the remainder being acetylphenylthiocarbamide; at lower temperatures, the proportion of thiocyanate and anilide rises,

and for temperatures below 30° reaches 90 per cent. and upwards of the total, whilst at temperatures above 87° the proportions are reversed, the yield of thiocarbamide increasing, with a corresponding decrease in the amount of the other two products, until in the neighbourhood of 120° the sum of the latter diminishes to some 2 or 3 per cent.

Although the thiocarbimidic character of acetyl thiocyanate, as measured by its power to yield the additive compound, acetylphenylthiocarbamide, increases regularly with the temperature of interaction, it would seem that this power is not acquired through ordinary isomeric change. For in all cases hitherto observed, the transformation by heat of a thiocyanate into a thiocarbimide is non-reversible, the latter representing the stable and permanent form, whereas here the percentage of acetylphenylthiocarbamide resulting at any given temperature is not affected by previous heating of the thiocyanate, but is determined solely by its temperature at the moment of interaction.

These phenomena come neither under the head of tautomerism proper, which is conditioned through the intramolecular migration of a hydrogen atom, nor into the category of migration of whole atomic groups: in point of elasticity, they present some resemblance to dissociation changes, but until further inquiry has been made the authors prefer not to advance definite views as to their nature and causation.

62. "A method of determining the specific gravity of soluble salts by displacement in their own mother liquor, and its application in the case of the alkali halides." By John Young Buchanan.

The method presents obvious difficulties of manipulation, but as it furnishes at one and the same time the specific gravity of the salt and that of its mother liquor, both being determined at the temperature of equilibrium, it may be sometimes advisable to encounter these difficulties.

This method has been applied in the case of the chlorides, bromides, and iodides of potassium, rubidium, and cæsium, and the following are the values obtained for the specific gravity D of each of these salts at the temperature T, referred to that of distilled water at the same temperature as unity.

Salt, MR.	KCl.	KBr.	KI.	RbCl.	RbBr.	RbI.	CsCl.	CsBr.	CsI.
Temp. T.	23·4°	23·4°	24·3°	22·9°	23·0°	24·3°	23·1°	21·4°	22·8°
Sp. gr. D.	1·951	2·679	3·043	2·706	3·210	3·428	3·982	4·455	4·508

63. "The combination of mercaptans with unsaturated ketonic compounds." By Siegfried Ruhemann.

The author has continued his research (*Trans.*, 1905, **87**, 17) on the union of mercaptans with olefinic ketonic compounds effected under the influence of bases, since on using hydrogen chloride as catalytic agen Posner frequently obtained mixtures, owing to the fact that mercaptans, besides combining additively at the ethylene linking, partly condensed with the ketonic group. Besides the compounds which previously had been described as being formed from mercaptans and mono-olefinic ketones, $\overset{|}{C}:\overset{|}{C}\cdot CO-$, other substances have been prepared by the union of benzylideneacetophenone and ethyl benzylidenebenzoylacetate.

Cinnamylideneacetophenone, the di-olefinic ketone of the type $\overset{|}{C}:CH\cdot CH:CH\cdot CO-$, as shown before (*loc. cit.*), takes up 1 mol. only of either phenyl mercaptan or *iso*amyl mercaptan, instead of 2 mols., as stated by Posner (*Ber.*, 1904, **37**, 509). This investigator has since acknowledged the error. The behaviour of cinnamylideneacetone is analogous; this substance unites with 1 mol. of phenyl mercaptan to yield the compound $C_6H_5\cdot CH:CH\cdot CH(S\cdot C_6H_5)\cdot CH_2\cdot CO\cdot CH_3$ (m. p. 53—54°), whilst according to Posner's statement an oil is thus formed, which on oxidation is transformed into a disulphone.

In harmony with the author's result is the fact that cinnamylidene-benzylideneacetone, $C_6H_5\cdot CH:CH\cdot CH:CH\cdot CO\cdot CH:CH\cdot C_6H_5$, unites with 1 mol. of either *iso*amyl mercaptan or phenyl mercaptan, but 2 mols. of mercaptan may also be added to the tri-olefinic ketone, yet the separation of the compound from the additive product with 1 mol. of the mercaptan which is formed at the same time has not been effected.

Moreover, the acetylenic ketone, methoxybenzoylphenylacetylene, $C_6H_5\cdot C{\equiv}C\cdot CO\cdot C_6H_4\cdot O\cdot CH_3$, unites with 1 mol. of phenyl mercaptan to form $C_6H_5\cdot C(S\cdot C_6H_5):CH\cdot CO\cdot C_6H_4\cdot O\cdot CH_3$ (m. p. 121—122°), which is yellow as compared with the additive substances of mercaptans with olefinic ketones, which are almost all colourless.

The olefinic cyclic ketones, benzylidenephenylmethylpyrazolone, $C_6H_5\cdot N\begin{cases}N{-}\overset{|}{C}\cdot CH_3\\ CO\cdot\overset{|}{C}:CH\cdot C_6H_5\end{cases}$, and benzylidenephenylazlactone,

$$C_6H_5\cdot C\begin{cases}N\cdot\overset{|}{C}:CH\cdot C_6H_5\\ O\cdot CO\end{cases},$$

unite with phenyl mercaptan, but, whilst the pyrazolone derivative forms an additive product (m. p. 140°) with 1 mol. of the mercaptan,

the azlactone takes up 2 mols. of phenyl mercaptan to yield a compound (m. p. 156—157°) which probably has the formula

$$C_6H_5\cdot CH_2(S\cdot C_6H_5)\cdot C(CO\cdot S\cdot C_6H_5)\cdot NH\cdot CO\cdot C_6H_5.$$

64. "The existence of a carbide of magnesium." By J. Trengove Nance.

The residue left after burning magnesium in carbon dioxide, if shaken with water or dilute hydrochloric acid, gives a smell resembling that of geraniums. This smell is always obtained when magnesium is heated with carbon, or in air containing carbon dioxide, and the residue treated as above. It is due to the presence of a hydrocarbon formed by the action of water on the residue, for it is driven off by heat, can be concentrated in a distillate, and if the gas is passed through a red hot tube together with air, carbon dioxide is formed.

The presence of acetylene from a carbide of magnesium being suspected, a mixture of magnesium powder and powdered wood charcoal was gently ignited. The yellowish residue was treated with dilute hydrochloric acid, and the gas, mainly hydrogen, which was vigorously evolved, gave the following indications of the presence of acetylene. It burnt with a faintly luminous, two-zoned flame, and when passed through ammoniacal cuprous chloride it produced a brownish-red precipitate. With ammoniacal cupric solutions, decolorised by hydroxylamine, a brilliant crimson precipitate was obtained (compare Ilosvay von Nagy Ilosva, *Ber.*, 1899, **32**, 2697; *Abstr.*, 1900, ii, 52). These precipitates dissolved, wholly or partially, in dilute hydrochloric acid, with evolution of acetylene, copper passing into solution.

By analogy, the carbide formed should be MgC_2, but it was not obtained in a sufficiently pure condition for a quantitative analysis. It does not seem to interact as vigorously with water as the calcium compound.

65. "Isomeric salts of the type $NR_1R_2H_3$. A correction. Isomeric forms of *d*-bromo- and *d*-chloro-camphorsulphonic acids." By Frederic Stanley Kipping.

The further study of the isomeric α- and β-salts, which the author obtained by combining ordinary *d*-bromo- and *d*-chloro-camphorsulphonic acids with *dl*- and with optically active bases, such as hydrindamine (*Trans.*, 1900, **77**, 861; 1903, **83**, 873), benzylhydrindamine (Kipping and Hall, *Trans.*, 1901, **79**, 430), methylhydrindamine (Tattersall and Kipping, *Trans.*, 1903, **83**, 918), and *l*-menthylamine (Tutin and Kipping, *Trans.*, 1904, **85**, 65), has brought to light the fact that the isomerism of these compounds is not determined by a

difference in the arrangement in space of the groups united with the quinquevalent nitrogen atom, such as is represented by the symbols X—N—H and H—N—X, but to the existence of *cis*- and *trans*-forms of *d*-bromo- and *d*-chloro-camphorsulphonic acids, containing the groups X—C—H and H—C—X, and now distinguished as the *α*- or normal and *β*- or *iso*-acids.

The isomeric acids are stable in neutral solutions of their salts in the free state and in presence of mineral acids, even at 100°; in presence of a free base, however, such as caustic potash, baryta (sodium carbonate), hydrindamine, &c., the salts of the normal acid are transformed to a small extent into those of the *iso*-form, whereas the latter are almost entirely converted into salts of the normal acid, equilibrium being attained apparently when at least 90—95 per cent. of the compound exists in the normal form. During this change, the two modifications doubtless become identical, both passing through one and the same unstable enolic form.

All the salts of ordinary *d*-bromocamphorsulphonic acid which have hitherto been described by the author and by others, excepting those obtained from *d*- and *l*-hydrindamine and then separated from the *β*-forms, are probably mixtures of the two isomerides; the only salts of the *iso*-acids which are yet known are those previously described as *βl*-hydrindamine *d*-bromocamphorsulphonate and the *β*-modifications of *d*- and *l*-hydrindamine chlorocamphorsulphonates.

The molecular rotation of *iso*-*d*-bromocamphorsulphonic acid is approximately $[M]_D$ +177°, that of the corresponding chloro-acid being about $[M]_D$ +233°, so that in one case the normal, in the other the *iso*-acid has much the higher value.

No new facts have yet been obtained as to the cause of the formation of the isomeric salts of *cis*-*π*-camphanic acid, but in view of the above-mentioned results it would seem that the explanation previously suggested is not the true one.

66. "Isomerism of α-bromo- and α-chloro-camphor." By Frederic Stanley Kipping.

The fact that the sulphonic acids derived from *α*-bromo- and *α*-chlorocamphor may be transformed into isomerides by the action of bases rendered it extremely probable that the simple halogen derivatives themselves would give rise to isomerides under similar conditions: the following experiments show this to be the case.

Pure ordinary *α* bromocamphor, dissolved in 96 per cent. alcohol, gave $[\alpha]_D$ +135°; on adding a very small quantity of sodium ethoxide

to the solution, the specific rotation fell to $[\alpha]_D^{\prime} + 122°$, a value which did not change appreciably during 24 hours or on acidifying the solution with acetic acid. Ordinary bromocamphor, therefore, is partially converted into the *iso*-form, which has a lower specific rotation, and in the alkaline solution a condition of equilibrium between the isomerides is rapidly attained.

Judging from the behaviour of bromocamphorsulphonic acid, this *iso*-α-bromocamphor should be stable in acid solution. Accordingly some ordinary bromocamphor was treated in alcoholic solution with sodium ethoxide and the solution almost immediately acidified; on evaporating, crystals of ordinary bromocamphor were first deposited; these were separated from the mother liquor and treated again with sodium ethoxide and acid successively, these operations being repeated several times. The combined mother liquors gave on evaporation an oily deposit which was distilled in steam, and then fractionally crystallised from light petroleum: the first deposits consisted of ordinary bromocamphor, but the later fractions crystallised slowly in camphor-like masses. The specific rotation of this product, which no doubt still contained ordinary bromocamphor, was $[\alpha]_D + 38{\cdot}5°$ in 96 per cent. alcohol; when, however, a trace of sodium ethoxide was added to the alcoholic solution, the specific rotation increased rapidly and attained a constant value approximately the same as that of the solution of ordinary bromocamphor to which sodium ethoxide had been added.

When, moreover, the camphor-like mass was dissolved in a little alcohol and a few drops of caustic soda added, a large quantity of ordinary bromocamphor separated in crystals.

These experiments seem to establish the existence of normal and *iso*-forms of α-bromocamphor, and they explain the use of the caustic potash or caustic soda which is added in isolating ordinary bromocamphor from the crude product of the bromination of camphor: this crude product, as shown by Marsh (Trans., 1890, **57**, 828), doubtless consists of a mixture of the two isomerides, possibly together with unchanged camphor, but the isolation of the pure *iso*-form would most likely be a very hard task, which, as Marsh himself suggests, he probably did not accomplish. Similar experiments to the above indicate that ordinary α-chlorocamphor is also capable of existence in a stable *iso*-form, and the matter is being further investigated.

67. "*l*-Phenylethylamine." By Frederic Stanley Kipping and Albert Edward Hunter."

In number 3 of the current *Berichte* (**38**, 801) there appears a paper by Marckwald and Meth, "Über Amidbildung zwischen optisch-activen Säuren und Basen und die optisch-activen α-Amidoethyl-

benzolen," containing certain statements respecting some work of ours to which we take exception (*Trans.*, 1903, **83**, 1147). Firstly, "Ihnen gelang wohl die Reindarstellung des Salzes der *l*-Base, aber die gewonnene Menge reichte zur Isolirung der reinen Base nicht aus"; also "K. & H. haben aus Mangel an Material das Drehungsvermögen des von ihnen gewonnenen *l*-Phenyläthylamin nur in wässrig alkoholischer Lösung bestimmt."

Neither statement is correct; we did not prepare the anhydrous base or determine its specific rotation merely because we were solely engaged in studying its salts.

The statement "Demnach haben Kipping and Hunter annähernd reines *l*-Phenylathylamin in Händen gehabt" suggests that our base contained some of the *d*-isomeride; this was not the case, and the specific rotation ($-3{\cdot}7°$) of the hydrochloride prepared by us was in fact slightly higher than that ($-3{\cdot}5°$) of Marckwald and Meth's preparation, although the difference is within the limits of experimental error.

The fact that the benzoyl derivative of the *l*-base melts at the same temperature as that of the *dl*-base, when both are crystallised from alcohol, and the fact that the specific rotation of the *l*-benzoyl derivative is extremely small according to Marckwald and Meth (only $+0{\cdot}3°$ in alcoholic solution) led us to state that the base "seems" to undergo racemisation during the preparation of its benzoyl derivative; our statement that "mixtures of the three compounds also melted at 120°" (*loc. cit.*, p. 1148) is doubtless correct, as the mixtures consisted of approximately equal quantities of the *d*-, *l*- and *dl*-benzoyl derivatives, and we omitted to examine the behaviour of a mixture of the *l*- and *dl*-compounds only.

68. "The influence of the hydroxyl and alkoxyl groups on the velocity of saponification. Part I." By Alexander Findlay and William Ernest Stephen Turner.

The following values of the saponification constant in aqueous solution have been determined (at 25°):

Ester.	k.	Ester.	k.
Ethyl phenylacetate	12·4	Ethyl phenylmethoxyacetate	23·3
Methyl mandelate	157	Ethyl phenylethoxyacetate	15·7
Ethyl mandelate	66	Ethyl phenylpropoxyacetate	(13·3)
Propyl mandelate	55		

The value for ethyl phenylpropoxyacetate was calculated from the values obtained in alcoholic solution.

The numbers in the foregoing table show at once the greatly

accelerating influence which the hydroxyl group exercises on the velocity of saponification, the constant being increased to about five times (for example, ethyl phenylacetate and ethyl mandelate). The increase in the affinity constants of the corresponding acids is about eight times. On replacing the hydrogen of the hydroxyl by an alkyl group, the velocity of saponification is diminished, and the diminution increases regularly with the mass of the alkyl group.

The velocity of saponification was also studied in aqueous alcoholic solution, the strength of which was 30 and 60 per cent. by weight. The values obtained were of course diminished by the addition of alcohol; they are contained in the following table:

Ester.	In 30 per cent alcohol. k.	In 60 per cent. alcohol. k.
Ethyl phenylacetate	8·6	(6)
Methyl mandelate	(109)	(84)
Ethyl mandelate	49·4	29·1
Propyl mandelate	39·5	22·7
Ethyl phenylmethoxyacetate.....	15·2	(8)
Ethyl phenylethoxyacetate	10·2	(6)
Ethyl phenylpropoxyacetate	—	(5)

The numbers enclosed in brackets are only approximate, as in the case of the esters to which they apply there was a great decrease in the value of the "constant" with the time.

At the next Ordinary Meeting, on **Wednesday**, April **19th**, 1905, at **5.30** p.m., the following paper will be communicated:

"Complex nitrites of bismuth." By W. C. Ball.

"*C*-Phenyl-*s*-triazole." By G. Young.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 29/4/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 294.

Wednesday, April 19th, 1905. Professor R. MELDOLA, F.R.S., President, in the Chair.

Mr. B. Perrott was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs. :

Joseph Bennett, North Adams, Mass., U.S.A.
Ralph Emerson De Lury, M.A., Manilla, Ontario, Canada.
Robert Donald, M.A., B.Sc., M.R.C.S., L.R.C.P., D.P.H., 75, Clyde Street, Dunedin, N.Z.
Ernest Lyle Carman Forster, M.A., Brampton, Ontario, Canada.

Of the following papers, those marked * were read :

*69. "Complex nitrites of bismuth."
By Walter Craven Ball.

A very unstable, yellow, crystalline *substance*, probably

$$Bi(NO_2)_3,2NH_4\cdot NO_2,NH_4\cdot NO_3,NaNO_3,$$

is precipitated by dissolving bismuth nitrate in sodium nitrite solution and pouring the resulting orange-coloured liquid into a saturated

solution of ammonium nitrate at 0°. A more stable yellow compound, *bismuth sodium ammonium nitrite*, $Bi(NO_2)_3,2NH_4\cdot NO_2,NaNO_2$, which crystallises in octahedra, is obtained by dissolving bismuth nitrate in concentrated ammonium nitrate solution and adding the resulting liquid to a saturated solution of sodium nitrite, cooled to 0°, and acidified with nitrous fumes.

A fairly stable, orange-yellow, *bismuth potassium nitrite*,

$$Bi(NO_2)_3,3KNO_2,H_2O,$$

is formed when nitrous fumes are passed into bismuth hydroxide suspended in a concentrated solution of potassium nitrite. All these salts, which are decomposed by water, have a slight green fluorescence.

Discussion.

Dr. L. F. Guttmann said that if the compounds described were analogous to the complex cobaltinitrites, it should be possible to prepare the corresponding barium or calcium double salt from the potassium compound, and asked whether the author had attempted to do so.

Mr. E. Grant Hooper expressed the opinion that precipitates produced as these substances were from saturated solutions might be expected to exhibit fair uniformity of composition if deposited under identical conditions, and that even close similarity of composition could not, in such circumstances, be deemed evidence that one was dealing with actual compounds, and not merely mixed salts. He thought that especial care was necessary when the "compounds" were immediately decomposed either in the process of recrystallisation or by any other treatment employed with the view of testing their individuality.

Mr. Ball, in reply, said that he had not succeeded in preparing pure specimens of other complex salts from the alkali double nitrites, mainly owing to their decomposition by solvents.

Mr. Hooper's view that these substances might be mixtures was rendered improbable by the fact that they had a well-defined crystalline form; moreover, they remained constant in composition even when prepared under varying conditions.

***70. "Experiments on the synthesis of the terpenes. Part II. Synthesis of Δ^3-*p*-menthenol(8), $\Delta^{3:8(9)}$-*p*-menthadiene, *p*-menthanol(8), $\Delta^{8(9)}$-*p*-menthene, and *p*-menthane." By William Henry Perkin, jun., and Samuel Shrowder Pickles.**

The authors deal with some hitherto unknown members of the terpene series which have been synthesised by employing Δ^1-tetrahydro-

p-toluic acid instead of Δ^3-tetrahydro-*p*-toluic acid, and describe the synthesis of those compounds enumerated in the title.

***71. "Experiments on the synthesis of the terpenes. Part III. Synthesis of aliphatic compounds similar in constitution to terpineol and dipentene." By William Henry Perkin, jun., and Samuel Shrowder Pickles.**

The authors describe the preparation of open chain compounds allied as closely as possible to the typical substances, terpineol and dipentene, in order to determine whether any great similarity in properties exists between such compounds and those members of the terpene group. The results indicate that probably the closed chain structure has a distinct influence on the properties of the terpenes and their derivatives.

***72. "Experiments on the synthesis of the terpenes. Part IV. Synthesis of Δ^3-normenthenol(8), $\Delta^{3:8(9)}$-normenthadiene, normenthanol(8), and $\Delta^{8(9)}$-normenthene." By Kōichi Matsubara and William Henry Perkin, jun.**

In view of the close relation between terpenoid compounds and cymene, the authors have prepared a number of substances allied to those described in Part II of this investigation, but differing from them in that they do not contain the methyl group.

73. "*C*-Phenyl-*s*-triazole." By George Young.

C-Phenyl-*s*-triazole, $\begin{matrix} N-NH \\ \| \\ CPh\cdot N \end{matrix}\!\!>CH$, previously obtained from 3-phenyl-1-methylhydroxy-1 : 2 : 4-triazole (*Trans.*, 1901, **79**, 665), has now been prepared from *C*-phenylhydroxy-*s*-triazole (*Trans.*, 1900, **77**, 226); it melts at 119·5—120°. The *silver nitrate* derivative, $C_8H_6N_3Ag,AgNO_3,H_2O$, is obtained as a white precipitate; the platinichloride, $(C_8H_7N_3)_2,H_2PtCl_6,3H_2O$, when treated with water, is converted into $(C_8H_{17}N_3)_2PtCl_4,3H_2O$. The *acetyl* derivative, $C_8H_6N_3\cdot C_2H_3O$, melts at 90°; the *carbamido*-derivative,

$$C_8H_6N_3\cdot CO\cdot NH_2,$$

melts at 117°.

74. "The resolution of inactive glyceric acid by fermentation and by brucine." By Percy Faraday Frankland and Edward Done.

Neuberg and Silbermann (*Ber.*, 1904, **37**, 339) state that by the action of lime on *d*-glucuronic acid they have obtained a glyceric acid, of which the anhydrous barium salt in aqueous solution gives $[\alpha]_D$ +17·1°, whilst by the resolution of inactive glyceric acid with brucine the enantiomorphous barium salt, with rotation $[\alpha]_D$ −17·4°, was obtained.

These mutually corroborative results were calculated to throw the gravest doubt on the accuracy of the rotation, $[\alpha]_D^{12°}$ − 10·01°, given by P. Frankland and Appleyard (*Trans.*, 1893, **63**, 299) for the barium salt of the active glyceric acid obtained by the fermentation of inactive calcium glycerate with the *Bacillus ethaceticus* (P. Frankland and Frew, *Trans.*, 1891, **59**, 81 and 96), whilst the optical purity of all the numerous other derivatives of the active fermentation glyceric acid were also thereby discredited.

The authors have in consequence reinvestigated the barium salts obtainable from the fermentation acid, on the one hand, and from brucine resolution of the inactive acid on the other, with the result that both salts were found to have the same rotation, $[\alpha]_D^{20°}$ − 10·9°, which is thus entirely at variance with the figures of Neuberg and Silbermann. The clue to this unaccountable discrepancy was, however, wanting until quite recently, when Neuberg and Silbermann, in a foot-note at the end of a publication in the *Zeitschrift für Physiologische Chemie* (1905, **44**, 146), explained that the above values previously given by them for the rotation of the *d*- and *l*- glycerates of barium were erroneous through their having used a faulty polarimeter (displacement of the zero of the instrument).

The complete coincidence between the activity of the barium salt of the fermentation acid and of that of the acid obtained by resolution with brucine conclusively proves, not only the optical purity of each, but also the reliability of the material (the active calcium glycerate of P. Frankland and Frew) from which so many optically active derivatives have been prepared.

The fractionally higher specific rotation for the barium salt found by the authors, as compared with that given by P. Frankland and Appleyard, is doubtless to be accounted for by the circumstance that the salt has now been obtained in a more perfectly crystalline condition. The calcium salt, which had already previously been obtained in large crystals, exhibited the same rotation as before.

75. "Estimation of potassium permanganate in the presence of potassium persulphate." By John Albert Newton Friend.

The author shows that small quantities of potassium permanganate may be correctly estimated iodometrically in the presence of potassium persulphate when the following precautions are observed:

1. The solution should be diluted to at least 150 c.c. before addition of the iodide.

2. Very little more iodide should be added than is necessary to reduce the permanganate.

3. The acidity should be reduced to a minimum.

In this way, small quantities of permanganate may be estimated in the presence of as much as 0·08 gram of persulphate.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Baker, Julian L. The brewing industry. pp. xii + 178. ill. London 1905. (*Recd.* 24/3/05.) From the Author.

Hoff, J. H. van't. Zur Bildung der ozeanischen Salzablagerungen. Heft 1. pp. vi + 85. ill. Braunschweig 1905. (*Recd.* 16/3/05.) From the Publishers.

Nieuwland, Julius A. Some reactions of acetylene. pp. 152. ill. Notre Dame, Indiana 1904. (*Recd.* 22/3/05.) From the Author.

Thomsen, Julius. Systematisk gennemførte termokemiske Undersøgelsers numeriske og teoretiske Resultater. pp. xii + 472. Copenhagen 1905. (*Recd.* 13/3/05.) From the Author.

Traité de chimie minérale. Publié sous la direction de Henri Moissan. Tome II, Fasc. 1. Tome IV, Fasc. 1. pp. v + 384, v + 592. (*Recd.* 6/4/05.) From Professor Henri Moissan.

Walmsley, R. Mullineux. Electricity in the service of man. pp. viii + 1208. ill. London 1904. From the Author.

II. *By Purchase.*

Godfrey, Ambrose and John. A curious research into the element of water; containing many noble and useful experiments on that fluid body. pp. 18. London 1747. (*Recd.* 23/3/05.)

Haller, A. Les récents progrès de la chimie. Conférences faites au Laboratoire de chimie organique de la Sorbonne, sous la direction de M. A. Haller. pp. 320. Paris 1904. (*Recd.* 12/4/05.)

Ingenhousz, John. Experiments upon vegetables, discovering their great power of purifying the common air in the sunshine, and of injuring it in the shade and at night; to which is joined, a new method of examining the accurate degree of salubrity of the atmosphere. pp. lxviii + 302 + xvii. London 1779. (*Recd.* 23/3/05.)

Porta, Giovanni Baptista. Magiæ naturalis libri viginti, in quibus scientiarum naturalium divitiæ et deliciæ demonstrantur. Iam de novo, ab omnibus mendis repurgati, in lucem prodierunt. pp. 670. ill. Frankfort 1597. (*Recd.* 7/3/05.)

Ramesey, William. De Venenis: or, a discourse of poysons, their names, natures, and vertues; with their several symptomes, prognosticks, and antidotes. pp. lxx + 240 + xvi. London 1663. (*Recd.* 7/3/05.)

Richter, V. von. Chemie der Kohlenstoffverbindungen oder organische Chemie. Zehnte Auflage. Band II. Carbocyclische und heterocyclische Verbindungen. Von R. Anschütz und G. Schroeter. pp. xxi + 894. Bonn 1903. (*Recd.* 13/4/05.)

Rose, T. Kirke. The metallurgy of gold. Edited by Sir W. C. Roberts-Austen. Fourth edition. pp. xvi + 554. ill. London 1902. (*Recd.* 13/3/05.)

Scheele, Carl Wilhelm. Chemische Abhandlung von der Luft und dem Feuer, 1777. Herausgegeben von W. Ostwald. (Ostwald's *Klassiker*, No. 58.) Leipzig 1894. (*Recd.* 28/2/05.)

Schmidt, Julius. Die Chemie des Pyrrols und seiner Derivate. pp. xii + 305. Stuttgart 1904. (*Recd.* 12/4/05.)

Simpson, W. Zymologia Physica; or, a brief philosophical discourse of fermentation from a new hypothesis of acidum and sulphur. Whereby the phœnomena of all natural hot baths, the generation of minerals, the production of many acidulæ or spaw-waters, the grand apparences of heat, fire, and light, throughout the triplicity of nature's dominions, in the productions of bodies, are solv'd from the intestine duellings and inward collisions of the foresaid principles. Whereby also various other subterraneal phœnomena, as damps, earthquakes, eruptions, etc., likewise the apparances of meteors, etc., and divers other no less remarkable then entertaining, are from the same doctrine of fermentation genuinely solv'd. With an additional discourse of the sulphur-bath at Knarsbrough. pp. xii + 152. London 1675. (*Recd.* 7/3/05.)

Strutt, Hon. R. J. The Becquerel Rays and the properties of radium. pp. vii + 214. ill. London 1904. (*Recd.* 17/2/05.)

Sue, Pierre. Histoire du galvanisme; et analyse des différens

ouvrages publiés sur cette découverte, depuis son origine jusqu'à ce jour. 2 vols. pp. xxiv + 335, 493. ill. Paris 1802. (*Recd.* 23/3/05.)

Valeur, Amand. Chimie et toxicologie de l'arsenic et de ses composés. pp. 364. ill. Paris 1904. (*Recd.* 7/3/05.)

Wilhelmy, Ludwig. Ueber das Gesetz, nach welchem die Einwirkung der Säuren auf den Rohrzucker stattfindet, 1850. Herausgegeben von W. Ostwald. (Ostwald's *Klassiker*, No. 29.) Leipzig 1891. (*Recd.* 28/2/05.)

III. *Pamphlets.*

Bradley, W. P., Browne, A. W., and Hale, C. F. Effect of mechanical vibration upon carbon dioxide near the critical temperature. (From the *Physical Review*, **19**, 1904.)

Calm, C. E. Sulphurous acid and sulphites as food preservatives. pp. 34. Chicago [1904].

Clarke, Frank Wigglesworth. The progress and development of chemistry during the nineteenth century. (From the *George Washington University Bulletin, Oct.* 1904.)

Ingenhousz, Jean. Observations sur la construction et l'usage de l'eudiomètre de M. Fontana, et sur quelques propriétés particulières de l'air nitreux. (From the *Journal de physique*, 1785.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can obtained from the Assistant Secretary, must be received on or before Monday, June 5th, 1905.

At the next Meeting, on **Thursday, May 4th,** 1905, at **8 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated :

"The synthesis of substances allied to adrenalin." By H. D. Dakin.

"Methylation of *p*-aminobenzoic acid by means of methyl sulphate." By J. Johnston.

"Some notes on sodium alum." By J. M. Wadmore.

"Camphoryl-ψ-semicarbazide." By M. O. Forster and H. E. Fierz.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 4th, 1905.

Amos, Arthur,

Spring Grove, Wye, Kent.

Agricultural Research at Rothamsted Laboratory. B.A., Cambridge, 1904. First Class Nat. Sci. Tripos, Part I.

A. D. Hall. Horace T. Brown.
N. H. J. Miller. E. J. Russell.
Henry Jackson.

Andrews, Albert Edward,

37, Oakhurst Grove, East Dulwich, S.E.

Assistant Chemist in the Research Laboratories of the Imperial Institute, S.W. Three years' course (1893—1896) in Chemistry at Finsbury Technical College, Leonard Street, E.C. Have since been continuously engaged under Professor Dunstan in the Research Laboratories of the Imperial Institute, where I now hold the Salters' Company's Research Fellowship.

Wyndham R. Dunstan. John Castell-Evans.
R. Meldola. Thomas A. Henry.
Ernest Goulding.

Baxter, John George,

"Court Sole," Cliffe, near Rochester, Kent.

Analytical Chemist. Served an Apprenticeship to an Analytical Chemist in business in Manchester. Have been manager of Chemical Works in London. Have erected and managed a small explosive works. Have been for 2 years Chemist to Cement Works and for the last 2 years Manager of Nine Elms Cement, Lime and Whiting Works. Have been Member of Society of Chemical Industry for many years.

H. H. Slater. H. Ellison, jun.
E. J. Read. J. Marsh.
W. J. Dibdin.

Belton, Francis George,
16, Clarkson St., Sheffield.

Student of Chemistry and Metallurgy. For 4 years assistant chemist to the Frodingham Iron and Steel Co., at present student of advanced chemistry at University College, Sheffield.

W. Palmer Wynne. W. E. S. Turner.
A. N. Meldrum. *L. T. O'Shea.*
Thos. Andrews.

Brettell-Vaughan, Edward Shipley Hewett Edwards, M.R.A.C.,
The Cwm, Aston-on-Clun, Salop.

Junior partner in firm of Vicarey & Co. (Consulting Experts of Storage Batteries), engaged in Research Laboratory on Chemistry of Fats, Oils, and Greases. Royal Agricultural College, Cirencester, Honours Degree of M.R.A.C. and holder of Certificates of Honour and Merit and Prizeman (by examination). Desirous of being in touch with the Society for purpose of consulting library and gaining the last and best possible works and literature on chemistry in general.

Maurice Blood. R. C. Marchant.
J. H. Davidson. Edward Kinch.
F. H. Alcock.

Clark, Thomas Walter Firth,
117, Clerkenwell Road, E.C., London.

Assistant Chemist. Twelve years in the Analytical and Manufacturing Laboratories of Messrs. Burgoyne, Burbidges & Co. Formerly Student at Finsbury Technical College and East London Technical College.

J. T. Hewitt. R. G. Halstead.
John Castell-Evans. *R. Meldola.*
Thos. Farries. *Clarence Smith.*
T. Pitt.

Colles, William Morris, jun.,
16, Birchington Road, West Hampstead, N.W.

Student. Worked in the Chemical Laboratory at University College for 5 years. B.Sc. (Lond.) Internal. 2nd Class Hons. Chemistry.

William Ramsay. Edward C. Cyril Baly.
J. Norman Collie. Samuel Smiles.
A. W. Stewart.

Coupe, Miles,

46, Millarbarn Lane, Waterfoot, near Manchester.

Works Chemist. Student of Chemistry and Dyeing for 10 years in various laboratories, including Bury and Rochdale Technical Schools, and the Manchester School of Technology. 1st Class Honours Chemistry, and Holder of various other certificates of the Board of Education. Silver Medallist in Honours Wool Dyeing, 1901, in Honours Silk Dyeing, 1902, and in Honours Calico Printing, 1903, under the City and Guilds; also several Honours Certificates (Coal-tar Products, &c.). I am engaged in Research Work.

J. C. Cain.	William Marshall.
Jul. Hübner.	*L. G. Radcliffe.*
W. J. Pope.	*Stanley J. Peachey.*
John Horsfall.	*Jas. Grant.*

Dodds, Roger,

Bigods Hall, Dunmow, Essex.

Science Master. Associate in Science and qualified in science portion of Examination for B.Sc. degree (University of Durham). Several years' experience in Technical Chemistry, in Cement Manufactory, and in Incandescent Lamp Factory.

P. Phillips Bedson.	S. Hoare Collins.
F. C. Garrett.	*J. T. Dunn.*

James Whittle.

Dunstan, Sydney,

107, Jesmond Road, Newcastle-on-Tyne.

Head Dispenser and Teacher of Pharmacy to the Royal Infirmary, Newcastle-on-Tyne. Member of the Pharmaceutical Society. Charge of Laboratory, the London Hospital, E. Assisted Dr. R. Hutchison in the analysis of Patent Medicines. Conducted all the experimental work during the compilation of the London Hospital Pharmacopœia. My studies in Analytical Chemistry were directed by Professors J. N. Collie, D.Sc., F.R.S., and A. Lapworth, D.Sc.

H. C. T. Gardner.	Hugh Candy.
Frederic Jas. M. Page.	Geo. F. Merson.

P. Phillips Bedson.

Evans, Bernard Scott,

Ferndale, 81, Babington Road, Streatham, S.W.

Analyst. B.Sc. Lond. 3½ years assistant to Leo Taylor, Esq., F.I.C., Public Analyst for Hackney. 4 years assistant to Lawrence Briant, Esq., F.C.S.

Lawrence Briant.	John T. Norman.
Arthur J. Starey.	Percy Edgerton.

Harold W. Harman.

Ferrier, John Greig,

2, Dalhousie Place, Arbroath, N.B.

Manufacturing Chemist. Pharmaceutical Chemist. Licentiate Pharmaceutical Society of Ireland. In charge of Pharmaceutical Laboratory, Abbeyhill Chemical Works, Edinburgh. Contributed "The Official Formulæ for Magnesium, Zinc and Lead Carbonates" (*Ph. J.*, pp. 586—587).

W. Watson Will. William Duncan.
H. Lucas. *Leonard Dobbin.*
F. Filmer De Morgan. *J. Gibson.*
David J. Williams. *John Hunter.*

Findon, Frank Standish,

41, Great Percy Street, Holford Square, W.C.

Clerk in Holy Orders. B.Sc. (St. Andrews University) with distinction in Chemistry; M.A. (2nd class Honours in Mathematics and Physics); formerly Science Master, Aberayron Intermediate School.

Thomas Purdie. G. D. Lander.
Alex. McKenzie. *Alex Findlay.*
Percy F. Frankland.

Finnemore, Horace,

21, Linden Mansions, Highgate, N.

Pharmacist and Instructor in Pharmaceutical Chemistry and Pharmacy at Guy's Hospital. Associate of the Institute of Chemistry. Joint Author with Dr. John Wade of "Influence of Moist Alcohol and Ethyl Chloride on the Boiling Point of Chloroform," *Trans.*, 1904, **85**, 938—949.

Author of "Spurious Virginian Prime Barks," *Pharmaceutical Journal*, Mar. 12th, 1904.

Late Demonstrator in Chemistry in the Pharmaceutical Society's School.

Thos. Stevenson. Arthur Lapworth.
John Wade. J. Norman Collie.
W. Palmer Wynne.

Glass, Archibald Melville,

73, Roderick Road, Hampstead, N.W.

Patent Agent, B.Sc. London (Honours in Physics). Engaged in technical patent work requiring chemical knowledge. Was technical adviser for 2 years to a company manufacturing secondary batteries.

Studied chemistry under Professor Meldola at the Finsbury Technical College, and Dr. J. E. Mackenzie at Birkbeck College.

Alfred F. Joseph. — John Castell-Evans.
R. Meldola. — F. Henry Streatfeild.
John E. Mackenzie.

Gorman, Henry Isaac,
126, Quay, Waterford.

Pharmaceutical Chemist. Formerly a student under Professor Tichborne (F.I.C.), Dublin. Desires admission to the Society in order to keep in touch with recent work in Chemistry.

Harold W. Harrie. — Chas. R. C. Tichborne.
Ernest J. Parry. — *Thomas Tyrer.*
Henry Boyers. — *J. H. Coste.*
Thomas Morson.

Green, Ernest,
113, Hulton Street, Moss Side, Manchester.

Science Teacher. Since 1890, Organising Science Master to the Salford School Board, who wishes to obtain the literature of the Chemical Society.

W. B. Hards. — Wm. Scholes.
B. Prentice. — Francis Jones.
E. Clark. — *James Walker.*
J. R. Appleyard. — *John S. Lumsden.*

Griffiths, John,
The Hollies, Upton Park, Chester.

Teacher. Graduate in Science, University of Wales. Science Master at The College, Cleobury Mortimer. Attended Chemistry (Theory and Practical) courses at University College of North Wales from October, 1899, until June, 1903.

James J. Dobbie. — Robt. D. Abell.
Alexander Lauder. — *W. F. Lowe.*
Allan Baguley. — *W. F. J. Shepheard.*
John Bairstow.

Groves, Samuel Ernest,
10, Melrose Avenue, Monkseaton, Northumberland.

Works Chemist. Passed the advanced examination in theor. chemistry and the Honours examination in practical chemistry of the Board of Education in 1901. From 1901 to 1903 engaged in analytical and research work in the Chemical Laboratory, King's

College, London. Since December, 1903, as Analyst and Assistant Manufacturing Chemist to Messrs. Holzapfels, Newcastle-on-Tyne.

John M. Thomson. Patrick H. Kirkaldy.
Herbert Jackson. A. K. Huntington.
D. Northall Laurie.

Hawthorne, John,

7, Roseneath Villas, Military Road, Cork.

Demonstrator, Queen's College, Cork. "On Ulva Latissima and its connection with Sewage Pollution." Letts and Hawthorne, *Proc.* R.S.E., 1900. "Ueber ein viertes Methylmorphimethin." Knorr and Hawthorne, *Ber.*, 1902. Junior Fellow in Chemistry, Royal University of Ireland.

Augustus E. Dixon. Edmund Albert Letts.
W. E. Adeney. J. Norman Collie.
William Ramsay.

Hetherington, Arthur Lonsdale,

Government Collegiate School, Rangoon.

Principal of the Government College School at Rangoon, Burma. 2nd Class in the Natural Sciences Tripos, Cambridge, in June, 1903. Chemistry Master at Highgate School since October, 1903.

R. H. Adie. George Dixon.
S. Ruhemann. *M. Kelway Bamber.*
Charles T. Heycock. *T. B. Wood.*

Howgate, James Henry, B.A. (Lond.),

The Avenue, Bakewell, Derbyshire.

Science Master, Lady Manners School, Bakewell. Teacher of Chemistry with management of Laboratories. Fifteen years' experience. Desirous of having the Society's Journals.

C. Jodrell Mansford. Frank Dixon.
Samuel Fenton Stell. A. L. B. Tindall.
Harold E. Richardson.

Kay, Sydney A.,

72, Market Street, St. Andrews.

Lecturer and Demonstrator in Chemistry, University of St. Andrews. Studied Chemistry at University College, Dundee, under Prof. P. F. Frankland, F.R.S., and Prof. J. Walker, F.R.S., 1893—97. D.Sc. (St. Andrews), 1902. Held "1851 Exhibition" Scholarship 1897—99, one year at Stockholm under Prof. Arrhenius, one year at Leipzig under Prof. Ostwald. Private Assistant to Prof. T. Purdie, F.R.S., St. Andrews, 1899—1900. University Assistant since 1900. Published work: "Equilibrium between Sulphuric Acid and Sulphates in

Aqueous Solution" (*Proc.* R. S. Edin.). With Prof. Walker, "On the so-called 'Hypoiodite of Magnesium'" (*Proc.* R. S. Edin.), and "Velocity of Urea Formation in Aqueous Alcohol" (*Trans. Chem. Soc.*).

Thomas Purdie.	Alex. Findlay.
James Walker.	Alex. McKenzie.
Percy F. Frankland.	Frank W. Young.

Killby, Leonard Gibbs,

10, Aberdeen Park, Highbury, London, N.

B.A. (Oxon). Scholar of New College, Oxford. First Class Honours in Chemistry—Honour School of Natural Science—June, 1904. Now Demonstrator in the Laboratory at Christ Church, Oxford, and engaged in research there.

H. Brereton Baker.	W. W. Fisher.
Alexander Scott.	R. C. T. Evans.
Allan F. Walden.	Charles E. Cassal.

Leek, William Henry,

Elm View, Leigh, Lancashire.

Head Master, Leigh Grammar School since 1895. (Graduate B.A., Univ. of London, 1889.) Teacher of Chemistry for South Kensington Exams. (Advanced and Honours). Teacher of Chemistry for Lancs. County Council Science Schools. Intermediate B.Sc. Exam., London, 1892. Worked for two years in the intervals of school duties in the Laboratory of the Borough Analyst of Bolton, 1897—1899. Is anxious to keep in touch with the results of modern research. For 1½ years worked under the direction of Rev. G. C. Chambres, Headmaster of Wigan Grammar School.

Walter Ratcliffe.	G. Crewe Chambres.
H. Lloyd Snape.	J. Parry Laws.
W. B. Hards.	

Lewis, Ernest Isaac,

Felsted School.

Schoolmaster. Chemistry Master, Felsted School, 1903—1905. Chemistry Master, Oundle School, 1905— . 1st Class Natural Sciences Tripos, Part I. B.A., 1902, Cambridge. B.Sc., London. Formerly Scholar of Gonville and Caius Coll., Camb.

R. S. Morrell.	H. O. Jones.
M. M. Pattison Muir.	A. E. Bellars.
H. J. H. Fenton.	*W. J. Sell.*

Maguire, Peter,

Hamar House, Rochdale, Lancs.

Chemist Colorist. Studied Chemistry for four sessions under Mr. W. Marshall, F.I.C., F.C.S., at the Rochdale Municipal Technical Schools, 1895—1898. Certificates, South Kensington Organic and Inorganic Chemistry. Medallist, City and Guilds London Institute in Cotton Dyeing. Late Works Manager, Marland Dyeing Co., Heap Bridge, Lancs. At present as Head-dyer and Chemist, in charge of the dyeing and bleaching departments of Mr. John Wilkinson, Park Mill, Skipton, Yorks.

William Marshall. W. H. Pennington.
James H. Kershaw. *Walter M. Gardner.*
A. G. Green.

Marle, Ernest Robert,

135, Le Marchant Road, S. John's, Newfoundland.

Science Lecturer. Assoc. R.C.S., B.Sc. Lond.

William A. Tilden. Chapman Jones.
M. O. Forster. James C. Philip.
George T. Holloway.

Martin, Francis Grimshaw,

King Henry VIII. School, Coventry.

Schoolmaster. Science Master at Tavistock Grammar School from Sept., 1896, to Xmas, 1899. From Jan., 1900, until Xmas, 1904, Science Master at Lucton School. At present Science Master at King Henry VIII. School, Coventry.

Frank B. Gatehouse. *W. de W. Abney.*
G. Percy Bailey. *Thomas Tickle.*
A. Louis Robinson. *Robert Wright.*

Morris, Edwin,

12, Dragon View, Harrogate.

Lecturer in Chemistry and Physics. Associate of the Royal College of Science (Physics). Associate of the Royal School of Mines (Metallurgy). Lecturer in Chemistry and Physics, Harrogate Technical School.

W. Gowland. G. T. Morgan.
M. O. Forster. W. H. Merrett.
James C. Philip.

Mortimer, Alfred,

Trinity College, Stratford-on-Avon.

Science Master. (1) B.A. Oxford. Final Honours School of

Chemistry, but was unable to be placed in the Honours list, having, owing to illness, exceeded the time limit. (2) A little research work in Organic Chemistry at the University Laboratory, Oxford, under the supervision of Mr. J. E. Marsh.

W. W. Fisher. T. V. Barker.
H. L. Bowman. R. de J. Fleming-Struthers.
J. E. Marsh.

O'Farrelly, Alfons, M.A.,
3, Holles St., Dublin.

Lecturer on Organic Chemistry, Royal College of Science, Dublin. Junior Fellow of the R.U.I. and Examiner in Chemistry to the Intermediate Education Board. Studied in the Universities of Berlin, Leipzig and Paris with Professors van't Hoff, Ostwald and Moissan. Work published in the Annals of the Prussian Academy and in the *Comptes rendus*.

W. N. Hartley. Edmund Albert Letts.
W. E. Adeney. J. Norman Collie.
William Ramsay.

Sarginson, William,
200, Cauldon Road, Stoke-on-Trent.

Science Teacher at the Municipal Secondary School, Hanley. B.Sc. (Vict.). Student in the Owens College for 3 years. Teacher of Chemistry in the Higher Grade School, Hanley. Wishes to obtain the latest chemical literature.

Harold B. Dixon. William A. Bone.
W. H. Perkin, jr. D. L. Chapman.
G. G. Quinn.

Shedden, Frank,
5, Belvidere Road, Walsall.

B.Sc. London, F.I.C. Science Master, The Grammar School, Newchurch, near Manchester. Joint author of papers which appeared in the Society's *Trans.*, 1902 and 1903. Abstractor to *Jour. Soc. Chem. Industry* and *Science Abstracts*. Student at Mason College, Birmingham. Research Chemist four years Wellcome Chemical Research Laboratories, London.

Percy F. Frankland. Frederick B. Power.
Alex. McKenzie. H. A. D. Jowett.
T. Slater Price. Frederic H. Lees.

Shepherd, Charles Stuart,

Worth Matravers Vicarage, Wareham, Dorset.

Clerk in Holy Orders. A Student at "The Bristol Laboratory at the Bristol Trade and Mining School" (The Precursor of the present "Merchant Venturers' Technical College"), under the late Mr. Thomas Coomber, F.C.S., and Professor Munro, D.Sc., F.C.S. After, passing the Examination of the Science and Art Department in Chemistry, Magnetism, etc., and attending the Lectures in Chemistry at King's College, London: held the position of Analytical Chemist at the Works of Messrs. Thomas Farmer & Co., London, Chemical Manure Manufacturers. Has since lectured on Scientific subjects under the Dorset County Council Technical Instruction Committee.

H. H. B. Shepherd. — Ernest H. Cook.
John M. H. Munro. — Bernard Dyer.
Alan McMullen. — *R. J. Friswell.*

Edward Kinch.

Speight, William Ewart,

Corporation Sewage Works, Deighton, Huddersfield.

Chemist and Manager of Sewage Works. For three years Student in Chemical Dept., Yorks College, Leeds. 5½ years Chemical Assistant, West Riding of Yorks. Rivers Board. Recently appointed Chemist at Huddersfield Corporation Sewage Works.

Arthur Smithells. — H. T. Calvert.
J. B. Cohen. — W. Lowson.

C. E. Whiteley.

Stennitt, Sydney Dockeray,

16, Richmond Terrace, Whitchurch, Salop.

Science Master. Grammar School, Whitchurch. B.Sc. (Vict.) Honours School of Chemistry. 1st Class 1901. M.Sc. 1904. Assistant Science Master at Newcastle, Staffs., 1902, 1903, 1904. Science Master at Whitchurch since September, 1904.

Harold B. Dixon. — Wm. A. Bone.
W. H. Perkin, jun. — D. L. Chapman.

Alfred Holt, jun.

Stevens, Edmund Henry,

Haw House, Rothbury, Northumberland.

Schoolmaster. Lecturer in Chemistry at Sharp's School, Rothbury.

G. Senior. — D. T. Richards.
Wm. A. Knight. — T. W. Berry.
W. B. Hards. — *Jas. H. Haynes.*

Stevens, Harold Blythen,
225, Oxford St., W.

Pharmaceutical Chemist. At present in charge of Messrs. John Bell and Co.'s manufacturing laboratory. Some time student at Nottingham University College (1896-99). Silver medallist in Chemistry, Dr. Muter's School of Pharmacy. Joint author of two papers:—(1) Determination of Iron in Iron Pills. (2) Examination of Compound Tincture of Cardamoms. Now reading for London University degree. (Matriculated Jan., 1905).

F. Stanley Kipping. R. M. Caven.
Frank Clowes. Walter Hills.
J. J. Sudborough. *W. Palmer Wynne.*

Swann, Robert Reed,
The Agricultural College, Aspatria, Cumberland.

Lecturer in Agricultural and General Chemistry at above College as above designated. B.Sc. (Dunelm), and formerly assistant in Agricultural Chemistry at Armstrong College, Newcastle-on-Tyne.

S. Hoare Collins. P. Phillips Bedson.
F. C. Garrett. *F. O. Solomon.*
J. T. Dunn.

Taylor, John William,
University College, Reading.

Analytical Assistant in the Agricultural Department, University College, Reading. Studied Chemistry and other Sciences, 1900—1903, and was student demonstrator in Chemistry, 1902—3. Have worked for 3 years at soil analysis under Dr. Luxmoore, and am at present studying for the London B.Sc. degree.

John Percival. C. M. Luxmoore.
E. K. Hanson. J. W. Dodgson.
T. B. Wood. C. W. Walker-Tisdale.
Julien Drugman.

Thomas, George Devenish,
8, Hubert Terrace, Dover.

Science Master, Municipal Art, Science, and Technical Schools, Dover. Four years' experience as Senior Science Master, Dover Municipal Schools, 1901—1905. Five years' experience as Senior Sciences Master, Bath Technical Schools, 1896—1901. Four years Demonstrator in Chemistry and Biology, Merchant Venturers' Tech.

Coll., Bristol, 1892—1896. B.Sc. (Chemistry, Physics, and Botany) London.

J. Wertheimer. James Leicester.
G. P. Darnell-Smith. W. H. Pendlebury.
Ernest H. Cook.

Titherley, Arthur Walsh,

Southcot, Moreton, near Birkenhead.

Assistant Lecturer and Demonstrator, University of Liverpool. D.Sc. (Victoria); D.Sc. (Liverpool); Ph.D. (Heidelberg). Author of papers (1894—1904) in the *Journal* of the Chemical Society on Metallic Amides, Organic Substitution Derivatives of Sodamide: their uses in Synthesis; the Acylation of Amides; Furfurol Derivatives, &c.; and in the *Annalen* on Derivatives of Glutaric Acid.

J. Campbell Brown. J. Norman Collie.
W. Collingwood Williams. William Ramsay.
F. G. Donnan.

Wall, Francis Henry,

14, Hardman Street, Liverpool.

Chemist and Druggist. Senior Assistant, c/o Messrs. Symes & Co., Ltd., Manufacturing Chemists, Liverpool. Qualified Chemist, "Minor" Pharm. Society of Gt. Britain, Apothecaries' Hall, Blackfriars, London. Late Day Student, "Inorganic Chemistry," Bridgnorth Grammar School. Late Day Student, "Organic and Inorganic," Westminster College, London. Late Evening Student, "Organic Chemistry," Polytechnic Institute, London. Evening Student, "Metallurgy," University of Liverpool.

Albert E. Bell. *J. Campbell Brown.*
Saml. Banner. *W. Collingwood Williams.*
James Smith. *Prosper H. Marsden.*

The following Certificates were authorised for presentation to Ballot by the Council under Bye-Law I (3):

Gillies, Albert,

Government Laboratories, Johannesburg, S.A.

Assistant Analyst and Assayer, Govt. Laboratories, Johannesburg. Four years' Chemical Training with W. A. Dixon, F.I.C., Sydney, N. S. Wales. Certificate from Sydney Technical College for Theoretical Chemistry. 14 months in present position in South Africa.

Walter C. C. Pakes. W. H. Jollyman.

Maughan, Reginald Bruce,

Box 46, Bundaberg, Queensland, Australia.

Manager of the Bundaberg Co-operative Dairy Co., Ltd. Attended the Hawkesbury Agricultural College, Richmond, N. S. Wales, for 16 months as Outdoor Dairy Student, then joined the N.S.W. Fresh Food and Ice Co., Ltd., Sydney; was with the firm for 5½ years, the last 4 years or so was Analyst to the Coy., having 3 or more students as assistants. While with the Coy., attended Dairy Chemistry Classes at the Technical College for six months. Have been in my present position for over four years.

G. S. Thomson. John Joseph Eastick.
H. W. Potts. *J. C. Brünnich.*

Spencer, Arthur Gordon,

P.O. Box 554, Montreal, Can.

Analytical Chemist. Some Compounds of Aluminium Chloride with Organic Substances, Walker and Spencer, *Trans.* Chem. Soc. 1904, Vol. 85, pp. 1106–1110. B.Sc. 1904. McGill University, Montreal. Mem. Soc. Chem. Ind. Two years as a steel works chemist, also Chief Chemist Dominion Coal Co., Glace Bay, N.A. Chief Assistant to City Analyst of Montreal at present time.

J. Wallace Walker. B. J. Harrington.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 12/5/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. **No. 295.**

Thursday, May 4th, 1905. Professor R. MELDOLA, F.R.S., President, in the Chair.

Mr. J. W. Wilkinson was formally admitted a Fellow of the Society.

A certificate was read for the first time in favour of Mr. Eric William Campbell, 97, Eaton Square, S.W.

A Ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

Arthur Amos, B.A.
Albert Edward Andrews.
John George Baxter.
Francis George Belton.
Edward Shipley Hewett Edwards Brettell-Vaughan.
Thomas Walter Firth Clark.
William Morris Colles, jun., B.Sc.
Miles Coupe.
Roger Dodds.
Sydney Dunstan.
Bernard Scott Evans, B.Sc.
John Greig Ferrier.
Frank Standish Findon, M.A, B.Sc.
Horace Finnemore.
Albert Gillies.
Archibald Melville Glass, B.Sc.
Henry Isaac Gorman.
Ernest Green.
John Griffiths, B.Sc.
Samuel Ernest Groves.
John Hawthorne.
Arthur Lonsdale Hetherington, B.A.
James Henry Howgate, B.A.
Sydney A. Kay, D.Sc.
Leonard Gibbs Killby, B.A.
William Henry Leek, B.A.
Ernest Isaac Lewis, B.A., B.Sc.
Peter Maguire.
Ernest Robert Marle, B.Sc.
Francis Grimshaw Martin.
Reginald Bruce Maughan.
Edwin Morris.
Alfred Mortimer, B.A.
Alfons O'Farrelly, M.A.
William Sarginson, B.Sc.
Frank Shedden, B.Sc.
Charles Stuart Shepherd.
William Ewart Speight.
Arthur Gordon Spencer, B.Sc.
Sydney Dockeray Stennitt, M.Sc.
Edmund Henry Stevens.
Harold Blythen Stevens.
Robert Reed Swann, B.Sc.
John William Taylor.
George Devenish Thomas, B.Sc.
Arthur Walsh Titherley, D.Sc., Ph.D.
Francis Henry Wall.

Of the following papers, those marked * were read :

***76. "Notes on sodium alum." By John Mello Wadmore.**

The following experiment was made with the object of gaining information with regard to sodium alum, the existence of which was affirmed by Zellner, in 1816, and subsequently by Augé (*Compt. rend.*, 1890, **110**, 1139), but denied by Ostwald (*Principles of Inorganic Chemistry*, English edition, 1902, p. 556).

By mixing, in solution, quantities of sodium and aluminium sulphates in the proportion of their respective formula weights, a substance was obtained, crystallising in octahedra and having the appearance of an alum; moreover, the analytical data agreed closely with the numbers calculated for sodium alum, $Na_2SO_4,Al_2(SO_4)_3,24H_2O$.

The solubility of the compound was determined at various temperatures and found to be considerable. Thus, 1 gram of water at 10·6° dissolves 1·0711 grams of the crystalline salt.

Attention is drawn to the fact that a hot concentrated solution, on cooling, deposits a pasty or oily substance which is slowly transformed into crystalline sodium alum. This paste may possibly be a homogeneous mixture of anhydrous, or partly hydrated, alum and water.

Finally, it is shown that, whilst sodium alum does not effloresce appreciably under ordinary conditions, it rapidly parts with about half its water of crystallisation at 50°, but a higher temperature is needed to dehydrate it completely.

Discussion.

Dr. Morgan said that the author's results seemed to agree very closely with those already set forth in a recent patent (G. Dumont, D.R.-P. 141670, Abstr., 1903, ii, 547), both observers having noticed the formation of the intermediate amorphous substance followed by that of a crystalline, non-efflorescent alum.

Recently, in a preparation of *p*-benzoquinone, when a fairly concentrated solution of sodium dichromate was employed, he had noticed the production of large, well-defined crystals of sodium chrome alum, and he asked whether the author had made any experiments on the formation of this double salt.

Mr. Wadmore, in reply to a remark by Dr. Harden, said that there were several objections to the view that the paste might consist of anhydrous sodium sulphate, but admitted that the point required further investigation.

As to the possible existence of sodium chrome alum, he had already made some experiments in this direction, and hoped shortly to be able to furnish definite information.

***77. "Camphoryl-ψ-semicarbazide." By Martin Onslow Forster and Hans Eduard Fierz.**

Camphoryl-ψ-semicarbazide, $C_8H_{14}<\begin{matrix}CH\cdot N(NH_2)\\ C(OH)-NH\end{matrix}>CO$, obtained by reducing camphorylnitroso-ψ-carbamide with zinc dust in dilute acetic acid, dissolves readily in water and crystallises from chloroform in minute, white needles melting at 193°; it has $[\alpha]_D$ 8·6°, and forms a definite *nitrate*, *cuprinitrate*, and *anhydride*.

Condensation with certain aldehydes and ketones takes place very readily, and many of the products have high specific rotatory power; the following cases are typical:

ψ-Semicarbazone.	M. p.	Solvent.	$[\alpha]_D$.	$[M]_D$.
m-Nitrobenzaldehyde	218°	Acetic acid	+84°	301°
Acetone	217	Chloroform	−188	498
Camphorquinone	234	,,	−314	1172
Benzaldehyde	223	,,	+421	1318
Furfuraldehyde	222	,,	+502	1522
Cinnamaldehyde	219	Ether	+605	2051
Benzoquinone	197	Acetone	−1051	3310

The camphoryl-ψ-semicarbazones are characterised by the tenacity with which they retain solvent of crystallisation; this property accounts for the profound influence on specific rotatory power exerted by various media. The cinnamylidene derivative, for example, has the following values in the solvents mentioned:

Solvent.	$[\alpha]_D$.	Solvent.	$[\alpha]_D$.
Ether	+605°	Nitromethane	+307°
Chloroform	527	Acetone	162
Phenetole	451	Alcohol	107
Bromobenzene	438	Acetic acid	96
Carbon disulphide	331	Pyridine	−54

Similarly, the benzoquinone derivative has $[\alpha]_D$ −1067° in chloroform and $[\alpha]_D$ −545° in alcohol.

Discussion.

Mr. W. Robertson pointed out that the influence of the unsaturated linking on the rotation of optically active compounds was apt to be misinterpreted. The increase due to such a linking depends also on the position of the ethylenic bond; for example, Rupe has shown that

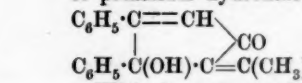
menthyl caproate and menthyl hydrosorbate have almost identical specific rotatory power, although one is saturated and the other unsaturated. On the other hand, if the linking is close to the asymmetric complex, or to a phenyl group, the change in rotation is very marked.

The PRESIDENT asked whether the compounds referred to by Dr. Forster as retaining their solvent of crystallisation with such obstinacy could be made to part with this attached solvent by heating, or whether they decomposed under this treatment. He congratulated the authors on having made what promised to be a most valuable addition to the agents available for the resolution of racemic neutral compounds such as aldehydes and ketones. The possible resolution of camphoryl-ψ-semicarbazide itself, referred to by Dr. Forster, had occurred to him also during the reading of the paper, and he suggested that some naturally occurring unsaturated open chain aldehyde possessed of optical activity, such as citronellal, might be found to answer the authors' requirements.

In reply to the President, Dr. FORSTER mentioned that the solvent of crystallisation is usually removed on prolonged exposure to a temperature approaching 100° without alteration on the part of the substances; attempts would be made to resolve the *pseudo*-semicarbazide on the lines suggested. He agreed with Mr. Robertson that the position of the unsaturated linking has influence on the rotation, but the series under consideration does not illustrate this point so clearly as Rupe's.

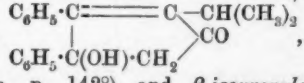
*78. "Some derivatives of anhydracetonebenzil."
By Francis Robert Japp and Joseph Knox.

The condensation of benzil with unsaturated ketones has not hitherto been studied. The authors find that benzil interacts with methyl *iso*butenyl ketone, $CH_3{\cdot}CO{\cdot}CH{:}C(CH_3)_2$, under the influence of potassium hydroxide to yield *β-isopropylideneanhydracetonebenzil*,

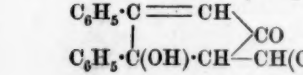


, slender, yellow needles (m. p. 205·5°).

With the corresponding saturated ketone, methyl *iso*butyl ketone, on the other hand, benzil condenses to form a mixture of *α-isopropylanhydracetonebenzil*,



, six-sided prisms or slender needles (m. p. 142°), and *β-isopropylanhydracetonebenzil*,

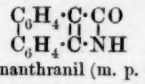


, flat needles (m. p. 161·5°).

***79. "The dihydrocyanides of benzil and phenanthraquinone. Second notice." By Francis Robert Japp and Joseph Knox.**

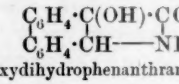
The authors find that when benzildihydrocyanide is treated with cold concentrated sulphuric acid, it yields *diphenylacetamide*, $(C_6H_5)_2CH{\cdot}CO{\cdot}NH_2$ (m. p. 167·5—168°).

Japp and Miller (*Trans.*, 1887, **51**, 33) obtained, by the action of fuming hydrochloric acid on acicular phenanthraquinonedihydrocyanide, two compounds, $C_{15}H_9ON$ (m. p. 241°) and $C_{15}H_{11}O_2N$ (m. p. 183°). The present authors, from a study of the reactions of these compounds, assign to them the following constitutions :



Phenanthranil (m. p. 241°).

and



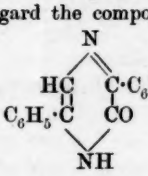
Hydroxydihydrophenanthranil (m. p. 183°).

Both compounds are capable of interacting also in the tautomeric form, and it is at present impossible to say whether the free substances are lactams, as here represented, or the corresponding lactims.

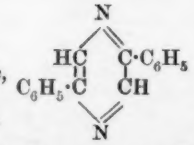
***80. "A condensation product of mandelonitrile." By Francis Robert Japp and Joseph Knox.**

By saturating a solution of mandelonitrile in absolute ether with hydrogen chloride, Minovici (*Ber.*, 1899, **32**, 2206) obtained a compound, $C_{16}H_{12}ON_2$, for which he gives the melting point 200—203°.

The authors show that this compound is identical with a substance melting at 196—197° previously obtained by Japp and Miller (*Trans.*, 1887, **51**, 29) by the action of hydrogen chloride on a solution of benzil in alcoholic hydrocyanic acid. They confirm the melting point given by Japp and Miller and regard the compound as 3-*keto*-2 : 5-*diphenyl*-3 : 4-*dihydro*-1 : 4-*diazine*,

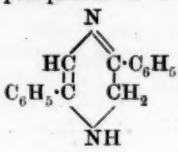


. By distillation with zinc dust, it yields 2 : 5-*diphenyl*-1 : 4-*diazine*,



(m. p. 194—195°), whilst by heating with hydriodic acid and red

phosphorus it is reduced to 2:5-*diphenyl*-3:4-*dihydro*-1:4-*diazine*,



(m. p. 162—163°).

***81. "Action of hydrazine on unsaturated γ-diketones."**
By Francis Robert Japp and James Wood.

C. Paal and Heinrich Schulze (*Ber.*, 1900, **33**, 3796) have shown that the *cis*- and *trans*-forms of *s*-dibenzoylethylene, $C_6H_5 \cdot CO \cdot CH{:}CH \cdot CO \cdot C_6H_5$, may be readily distinguished from one another by the greater ease with which the *cis*-form interacts with hydrazine to form a 1:2-diazine.

The present authors have employed this reaction to ascertain the configurations of some analogous unsaturated γ-diketones: αβ-dibenzoylstyrene, dibenzoylstilbene, and α-benzoyl-β-trimethacetylstyrene. One result has been to confirm the configurations assigned to the different modifications of the two former compounds by Japp and Klingemann (*Trans.*, 1890, **57**, 667), namely:

	cis-Form.	*trans*-Form.
αβ-Dibenzoylstyrene	m. p. 129°	m. p. 197—198°
Dibenzoylstilbene	m. p. 220°	m. p. 232°

The *trans*-forms do not interact with hydrazine.

The only known form of α-benzoyl-β-trimethacetylstyrene (m. p. 115°) has the *cis*-configuration.

82. "The synthesis of substances allied to adrenaline."
By Henry Drysdale Dakin.

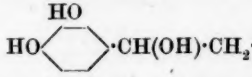
An account has recently appeared of the production of some compounds allied to adrenaline (D.R.-P. 157300; *Chem. Centr.*, 1905, **i**, 315), which have also been independently prepared by the author (*Proc. Physiol. Soc.*, 1905).

Methylaminoacetyl catechol, $C_6H_3(OH)_2 \cdot CO \cdot CH_2 \cdot NH \cdot CH_3$, which is obtained by the action of methylamine on chloroacetylcatechol (Stolz, *Ber.*, 1904, **37**, 4149), is crystalline and melts at 232°; it forms soluble crystalline salts which are perfectly stable. The solution of the salts are very faintly acid and the base is precipitated by sodium acetate. The base forms finely crystalline derivatives with phenylhydrazine acetate and with sodium hydrogen sulphite.

Natural adrenaline is generally assumed to be a secondary alcohol, whilst the above synthetical base is to be regarded as the corresponding ketone. On electrolytic reduction of the ketone or its bisulphite compound, a base is obtained which is probably not identical with racemic adrenaline. This product forms deliquescent crystalline salts (for example, the hydrochloride and oxalate), the solutions of which are practically neutral. The free base is not precipitated from a solution of its salts by sodium acetate. The hydrochloride gives a precipitate with potassium ferrocyanide on boiling and shows the usual colour reactions of catechol derivatives; it is unstable in hot aqueous solution, and is very readily decomposed by alkali even in the cold with evolution of methylamine. It has some physiological properties which are closely allied to those of adrenaline.

On addition of ammonia in slight excess to solutions of the salts, the free base is precipitated as a white, amorphous precipitate which is very sparingly soluble in most neutral solvents. The base may be kept for some little time suspended in water, but it is extremely unstable when dry, passing rapidly into a brown, insoluble substance with much less pronounced basic properties. This change may be analogous to that observed in the case of ω-aminoacetophenone. Owing to experimental difficulties, satisfactory analytical data and molecular weight determinations have not yet been obtained.

The preparation of a base which is probably identical with the substance just described is given in the above-mentioned German patent; this product is obtained by acting on methylaminoacetylcatechol sulphate with aluminium shavings in the presence of mercuric sulphate, and it is assumed to have the following constitution:



If this is correct, the formula for natural adrenaline will require modification, but the author is of opinion that the available evidence is insufficient to determine whether the synthetical base is a secondary alcohol or whether it possesses another of several possible alternative structures.

Homologous bases of similar chemical and physiological properties have been obtained by the electrolytic reduction of ketonic bases obtained by the action of various amines on chloroacetylcatechol.

83. "Methylation of *p*-aminobenzoic acid by means of methyl sulphate. Preliminary Note." By John Johnston.

By means of methyl sulphate, a practically quantitative yield of *p*-methylaminobenzoic acid may be obtained from *p*-aminobenzoic acid in presence of water. This compound is identical with that obtained by the action of methyl iodide on *p*-aminobenzoic acid, and melts at 144—145°. The melting point of the acid prepared by Houben (*Ber.*, 1904, **37**, 3978) is given as 228—229°, and the melting point of the acid prepared by Jaffé (*Ber.*, 1905, **38**, 1208) is given as 155—156°. Methyl *p*-methylaminobenzoate was prepared and melts at 75—76°.

p-Dimethylaminobenzoic acid was prepared by the further action of methyl sulphate on the monomethyl derivative; it melts at 235—236° and is identical with the product prepared by Michler (*Ber.*, 1876, **9**, 401).

The process of methylation cannot be carried further by means of methyl sulphate in aqueous solution, the best method for the preparation of the trimethyl derivative being that described by Michael and Wing (*Amer. Chem. J.*, 1887, **7**, 195).

84. "The atomic weight of nitrogen. Preliminary notice." By Robert Whytlaw Gray.

Many workers have pointed out that the atomic weight of nitrogen deduced by means of Avogadro's law from the relative densities of the pure gas and oxygen lies very near to the number 14·000 (Leduc, *Ann. Chim. Phys.*, 1898, [vii], **15**, 5).

When the two gases are compared under conditions in which this law may be considered to be strictly correct, the maximum value obtained lies below 14·010 (Guye, *Compt. rend.*, 1904, **138**, 1213; Rayleigh, *Phil. Trans.*, 1905, *A* **204**, 351).

The value 13·990 derived in a similar manner from nitrous oxide is also very close to these (Guye and Pintza, *Compt. rend.*, 1904, **139**, 677).

The researches of Stas, however, lead to a totally different number, namely, 14·055, and the two sets of experimental results, if accepted, lead to the conclusion that either (1) the law of Avogadro is not true for gases containing nitrogen, or (2) the relative weight of the atoms of nitrogen and oxygen is not a constant.

To throw light on this point, a careful study has been made of nitric oxide and the atomic weight of nitrogen has been deduced: (1) from the relative densities and compressibilities of nitric oxide and oxygen,

(2) from the decomposition of nitric oxide by means of finely divided nickel.

In an earlier notice (*Proc.*, 1903, **19**, 66) the weight of a litre of nitric oxide was stated to be 1·3402 grams under normal conditions (lat. Paris). Since then, a much more elaborate purification of the condensed gas has been carried out in order to free it absolutely from the last trace of nitrogen, and the mean of 10 new experiments gave 1·3406 grams for the weight of a litre at 0° and 760 mm. (lat. Paris).

On correction by means of Berthelot's formula, 30·005 was obtained for the molecular weight of the gas, and hence the value 14·005 for the atomic weight of nitrogen.

The accurate analysis of nitric oxide proved a matter of difficulty; iron wire absorbed only slowly all the oxygen and yielded traces of a gas condensable in liquid air which was probably cyanogen. With copper, the reaction was incomplete. Finally, it was found that the decomposition by means of finely divided nickel, discovered by Sabatier and Senderens (*Compt. rend.*, 1892, **114**, 1429), was an absolute one and capable of being carried out with great accuracy. Before an experiment, the nickel was heated to bright redness in a vacuum to expel hydrogen and traces of moisture.

The nitric oxide was decomposed in the same bulb in which it was weighed and the nitrogen was afterwards absorbed in a bulb containing charcoal and cooled in liquid air. In this way, a complete analysis of the gas was made. The nickel oxide was found to contain traces of nitrogen, which were only expelled after heating to redness in a vacuum for a considerable time.

Six experiments were made, and the mean value for the atomic weight of nitrogen was found to be 14·006. This number is possibly a little too low and more analyses are in progress.

85. "The methylation of gallotannic acid." By Otto Rosenheim.

The rediscovery of the optical activity of gallotannic acid rendered untenable the generally accepted formula for digallic acid put forward by Schiff (compare Rosenheim and Schidrowitz, *Trans.*, 1898, **73**, 878 and 885, and *Proc.*, 1899, **14**, 67), as this configuration does not contain an asymmetric carbon atom. It was thought that the study of the methylation products of this substance and their subsequent hydrolysis might provide a clue as to its constitution. In view of the recent publication of Herzig and Tscherne (*Ber.*, 1905, **38**, 989), and as the author of the present communication is unable to continue the work, a short statement of the results already obtained seems justified.

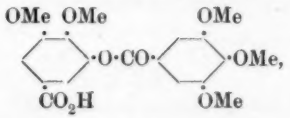
It was found that methyl groups could be introduced into the gallo-

tannic acid molecule with the greatest ease by means of methyl sulphate. In alkaline solution, the reaction takes place in the cold, and a white, amorphous substance is obtained, the yield being about 100 per cent. of the gallotannic acid. The product may be purified by pouring its alcohol or acetone solution into water; it begins to melt at 95—98° and is decomposed at a higher temperature, giving off carbon dioxide. It is insoluble in water, easily soluble in acetone, pyridine, or benzene, and resembles the parent substance in being dextrorotatory; a 2 per cent. solution in acetone shows a rotation of 20′ in a 100 mm. tube. The analytical data indicate the formula $C_{19}H_{20}O_9$, according to which the substance is a pentamethylgallotannic acid, but owing to the amorphous nature of the substance its purity cannot, as yet, be guaranteed, and the numbers obtained are only approximate.

The compound obtained by Herzig and Tscherne, by means of diazomethane, gave numbers agreeing with the formula $C_{25}H_{10}O_7(O{\cdot}CH_3)_8$ or $C_{24}H_8O_7(O{\cdot}CH_3)_8$.

From the products of acid hydrolysis, two optically inactive substances are isolated, which are both soluble in ether and may be separated by fractional crystallisation from water. The less soluble substance crystallises in long needles (m. p. 164°) and was recognised as trimethylgallic acid, whilst the more soluble compound, which was obtained in small, acicular crystals (m. p. 187°), was identified with the dimethylgallic acid prepared by Herzig and Pollak (*Monatsh.*, 1902, **23**, 700).

Assuming the validity of the old gallotannic acid formula, these results seem to agree with the following constitution:



which again, however, does not account for the optical activity of the substance.

86. "The interaction of hydrogen sulphide and sulphur dioxide." By William Robert Lang and Charles Macdonald Carson.

When hydrogen sulphide is passed into an aqueous solution of sulphur dioxide for several periods of from two to three hours on successive days, a milky solution is obtained which is termed Wackenroder's solution (Wackenroder, "On Pentathionic Acid," *Arch. Pharm.*, 1846, **48**, 272, 140; Berzelius, *Jahresbericht*, 1847, **27**, 36). This has been investigated by Debus (*Trans.*, 1888, **53**, 278), who proved the pre-

sence therein of sulphur, and sulphuric, trithionic, tetrathionic, and pentathionic acids, and probably hexathionic acid. The salts of these acids were examined by Hertlein (*Zeit. physikal. Chem.*, 1896, **19**, 287), who described methods for their separation and their physical properties. The explanation given by Debus for the formation of the polythionic acids is that tetrathionic acid is a direct product of the reaction of hydrogen sulphide on sulphurous acid, and that the other acids are formed from it by various subsequent reactions.

In order to investigate this, the reaction was effected, not in solution, but in the presence of a very little moisture, without which the gases do not interact. A large flask was surrounded with snow, a little moisture blown in, and the two gases then passed in at about equal rates for from two to three hours. A heavy yellow deposit, formed in the body of the flask, but not in the neck, was probably due to condensation of water having taken place only on the colder portions of the glass. This yellow material resembled ordinary sulphur, was dry to the touch, and quite brittle. On treatment with cold water, a milky liquid was obtained and the substance became stringy; this product, when boiled with water, was rendered soft and elastic.

Deposits formed by the above methods at different times, on being heated to 100° for an hour, lost from 25—30 per cent. by weight, and on estimating the sulphur compounds contained in them (as sulphuric acid) the amount never exceeded 1 per cent. Weighed quantities of the yellow material were allowed to remain in both open and closed tubes for several days at temperatures below 0°, but no change was noticeable in any case. When heated at 100°, the same loss of weight was observed as before; the presence of hydrogen sulphide could in no case be detected. Since the residue, after heating, contained more than 99 per cent. of free sulphur, it may be concluded that the polythionic acids were present in extremely small amounts.

Several quantities of the yellow material were next placed in stoppered bottles at the temperature of the room. After one day, the sulphur had become pliable and elastic and was covered with an oily liquid having an acid reaction, while a strong odour of sulphur dioxide was perceptible on removing the stoppers. The amount of this liquid seemed to increase after the second day, and this was proved to be the case on estimating the sulphuric acid present in quantities which had stood for one and two days respectively, and which had afterwards been heated at 100°. This liquid was then obtained in larger quantities, and was found to have a sp. gr. usually above 1·35, and to correspond with what is commonly called pentathionic acid, and which Debus showed to be a mixture of polythionic acids. Around the neck of the bottles, while below 0°, colourless crystals had formed: these were in such small amounts that their composition was not determined,

although, on warming, they gave off sulphur dioxide and left a deposit of sulphur.

It would appear from the above experiments that the action of gaseous hydrogen sulphide on gaseous sulphur dioxide produces first sulphur and water according to the equation,

$$2H_2S + SO_2 = S_3 + 2H_2O,$$

with sulphur dioxide present in the sulphur in considerable quantities. The last two substances slowly interact at comparatively higher temperatures, giving rise to polythionic acids.

An attempt was made to investigate the action of anhydrous liquid hydrogen sulphide on liquid sulphur dioxide, but the drying of the gases was probably not thorough enough. About 5 c.c. of liquid hydrogen sulphide were collected in a thick-walled glass tube surrounded by a freezing mixture, dry sulphur dioxide passed in until the volume of the mixed liquids measured some 15 c.c., and the tube then sealed at the blowpipe. A slight yellow deposit was formed where the tube was sealed. After one day, a thin yellow film had formed at the upper part of the tube which gradually increased, and when the tube was opened after one week there was found in the bottom a solid lump of sulphur covered by a clear liquid. This liquid, when allowed to evaporate, gave off sulphur dioxide and left a small quantity of water containing dissolved sulphur dioxide.

Methods for the detection and estimation of the different polythionic acids which will, it is hoped, enable the composition of the oily mixture of acids to be accurately determined are at present being investigated.

87. "The formula of cyanomaclurin." By Arthur George Perkin.

Although cyanomaclurin bears a close relationship to catechin, $C_{15}H_{14}O_6$, and analyses of its derivatives were in harmony with the suggestion that it was isomeric with this substance (*Proc.*, 1904, **20**, 171), it is now found by exhaustive analysis of the compound itself purified in various ways that the formula $C_{15}H_{12}O_6$ is to be preferred. Consequently its derivatives are to be represented as follows: acetyl cyanomaclurin, $C_{15}H_7O_6(C_2H_3O)_5$; benzoylcyanomaclurin, $C_{15}H_7O_6(C_7H_5O)_5$; benzeneazocyanomaclurin, $C_{15}H_{10}O_6(C_6H_5N_2)_2$, and acetylbenzeneazocyanomaclurin, $C_{15}H_7O_6(C_6H_5N_2)_2(C_2H_3O)_3$.

ADDITIONS TO THE LIBRARY.

II. *By Purchase.*

Blyth, Alexander Wynter, and Blyth, Meredith Wynter. Foods: their composition and analysis. With an introductory essay on the history of adulteration. 5th edition. pp. xxv + 616. ill. London 1903. (*Recd.* 19/4/05.)

Castell-Evans, John. Physico-chemical tables. Vol. I. Chemical engineering and physical chemistry. pp. xxxii + 548. London 1902. (*Recd.* 19/4/05.)

Collins, Henry F. The metallurgy of lead and silver. Part I. Lead. Part II. Silver. 2 vols. pp. xvi + 368, xvi + 352. ill. London 1899, 1900. (*Recd.* 19/4/05.)

Davis, George E. A handbook of chemical engineering, illustrated with working examples and numerous drawings from actual installations. 2nd edition. 2 vols. pp. xvi + 531, vii + 526. ill. London 1904. (*Recd.* 19/4/05.)

Findlay, Alexander. The phase rule and its applications, together with an introduction to the study of physical chemistry, by Sir William Ramsay. pp. lxiv + 313. ill. London 1904. (*Recd.* 19/4/05.)

Foster, Sir Clement Le Neve, and Haldane, J. S., *editors*. The investigation of mine air: an account by several authors of the nature, significance, and practical methods of measurement of the impurities met with in the air of collieries and metalliferous mines. pp. xii + 191. ill. London 1905. (*Recd.* 19/4/05.)

Julian, H. Forbes, and Smart, Edgar. Cyaniding gold and silver ores. A practical treatise on the cyanide process. pp. xx + 405. ill. London 1904. (*Recd.* 19/4/05.)

Lehfeldt, R. A. Electro-chemistry. Part I. General theory. Including a chapter on the relation of chemical constitution to conductivity, by T. S. Moore. pp. ix + 268. ill. London 1904. (*Recd.* 19/4/05.)

Lunge, George. Coal-tar and ammonia. 3rd edition. pp. xvi + 929. ill. London 1900. (*Recd.* 19/4/05.)

Mellor, J. W. Chemical statics and dynamics, including the theories of chemical change, catalysis, and explosions. pp. xiv + 528. London 1904. (*Recd.* 19/4/05.)

Redgrave, Gilbert R., and Spackman, Charles. Calcareous cements: their nature, manufacture, and uses, with some observations upon cement testing. 2nd edition. pp. xviii + 310. ill. London 1905. (*Recd.* 19/4/05.)

Young, Sydney. Fractional distillation. pp. xii + 284. ill. London 1903 (*Recd.* 19/4/05.)

III. *Pamphlets.*

Mingaye, John C. H. Notes on, and analyses of, the Mount Dyrring, Barraba, and Cowra meteorites. (From the *Records Geol. Survey, N.S. Wales*, 7, 1904.)

Mingaye, John C. H., and White, Harold P. Analyses of leucite basalts, &c., and olivine basalts from New South Wales. (From the *Records Geol. Survey, N.S. Wales*, 7, 1904.)

Shaw, G. W. California olive oil; its manufacture. (Univ. of California, College of Agriculture Bulletin, No. 158.) Sacramento 1904.

Twight, E. H., and Ash, Charles S. Contribution to the study of fermentation. (Univ. of California, College of Agriculture Bulletin, No. 159.) Sacramento 1904.

Waidner, C. W., and Burgess, G. K. Optical pyrometry. (From the *U.S. Bureau of Standards, Bulletin No.* 2, 1905.)

Woods, C. D., and Mansfield, E. R. Studies of the food of Maine lumbermen. (U.S. Dept. of Agric. Office of Experiment Stations, Bulletin No. 149.) Washington 1904.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, June 5th, 1905.

At the next Meeting, on **Wednesday**, May **17th**, 1905, at **5.30**. p.m., the following papers will be communicated:

"The chlorination of methyl derivatives of pyridine. Part I. 2-Methylpyridine." By W. J. Sell.

"The absorption spectra of uric acid, murexide, and the ureides in relation to colour and to their chemical structure." By W. N. Hartley.

"Further studies on dihydroxymaleic acid." By H. J. H. Fenton.

"The thermal decomposition of formaldehyde and acetaldehyde." By W. A. Bone and H. L. Smith.

"The synthesis of formaldehyde." By D. L. Chapman and A. Holt, jun.

"The influence of light on diazo-reactions. Preliminary notice." By K. J. P. Orton, J. E. Coates, and, in part, F. Burdett.

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Issued 30/5/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. **No. 296.**

Wednesday, May 17th, 1905. Professor R. MELDOLA, F.R.S., President, in the Chair.

Messrs. D. L. Chapman and A. E. Bellars were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Edward Williams Bealey, B.A., 55, Belsize Park Gardens, Hampstead, N.W.
William James Bees, B.Sc., 43, Ash Grove, Hyde Park, Leeds.
William Robert Bousfield, M.A., K.C., St. Swithin's, Hendon.
William Beaverly Cowie, 26, East Claremont Street, Edinburgh.
William Walpole Day, B.Sc., Ellerslie, Harrogate.
Herbert Henstock, B.Sc., Feldeggstrasse 33, Zürich V, Switzerland.
William John Jarrard, B.Sc., 41, Whittingstall Road, Fulham, S.W.
Arthur Walter Mason, B.Sc., 6, Northumberland Place, North Shields.
Frederick Wilson Montrose Ross, 21, Soho Square, W.
James Steger, B.Sc., 111, Chesterfield Road, Bristol.
William Bradshaw Tuck, University College, Gower Street, W.C.
John William White, 9, Hampden Place, Halifax, Yorks.
William James Wren, 271, Park Road, Oldham.

Of the following papers, those marked * were read :

*88. **"The desmotropic form of substances of the ethyl acetoacetate type in the homogeneous state and dissolved in neutral media.' By Julius Wilhelm Brühl and Heinr ch Schröder.**

The authors claim to have established by strict proof that both the primary ethyl acetoacetates and their secondary and tertiary alkyl substitution products, and also the camphorcarboxylic esters and their alkyl derivatives, although liquid, display a pure uniform ketonic structure and contain no traces of tautomeric enolic structures, which can be demonstrated by experiment.

The following table gives, firstly, the spectro-chemical molecular functions of ethyl acetoacetate when dissolved in water, methyl alcohol, or chloroform; secondly, the constants of the homogeneous undissolved ester, and finally those of the ester dissolved in ethyl-alcoholic sodium ethoxide.

Ethyl acetoacetate.	Percentage of ester dissolved.	$\left(\frac{n^2-1}{n^2+2}\right)\frac{P}{d} = M.$		
		M_α.	M_D.	$M_\gamma - M_\alpha$.
Dissolved in water	6·960	31·61	31·76	0·77
	8·895	31·66	31·82	0·79
Dissolved in methyl alcohol	30·20	31·87	32·05	0·89
	56·68	31·83	31·98	0·86
Dissolved in chloroform ...	22·50	31·93	32·11	0·90
	44·61	31·89	32·05	0·88
Homogeneous.....	100·0	31·80	31·96	0·87
Dissolved in 12·68 per cent. sodium ethoxide	19·29	35·38	35·77	2·45

The table indicates, moreover, that the functions of the dissolved ethyl acetoacetate obtained from all solutions in neutral media are practically identical (compare *Ber.*, 1905, **38**, 1868).

DISCUSSION.

Mr. BALY asked Professor Brühl whether he had investigated the compounds under the influence of ultra-violet light. According to experiments on the ultra-violet absorption spectra by Dr. Desch and himself, it appeared that the metallic derivatives in alkaline or neutral solvents are equilibrium mixtures of the two tautomeric forms. It

seems probable from these and some later results that the more stable condition of the metallic derivatives is the enolic form, and that under the influence of the ultra-violet light some of the ketonic modification is formed, and an equilibrium between the two forms is set up.

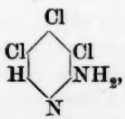
Professor BRÜHL, in reply to Mr. Baly, said that he had not investigated aqueous solutions of the sodium derivative of ethyl acetoacetate, but had only examined the substance dissolved in the alcohols. Aqueous solutions are partly hydrolysed and must therefore contain both the free ketonic ethyl acetoacetate and the enolised sodium derivative. On the other hand, solutions of this derivative in the anhydrous alcohols are not at all hydrolysed, and they contain only a single form, namely, the enolic one.

He also pointed out that Mr. Baly worked in very dilute solutions, and under these conditions the chemical relations would differ from those obtaining in the concentrated solutions used by himself and Schröder.

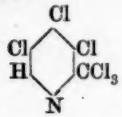
It is also possible that the very energetic ultra-violet light used by Mr. Baly exerts some action on the solutions of substances capable of being tautomerised.

***89. "The chlorination of methyl derivatives of pyridine. Part I. 2-Methylpyridine." By William James Sell.**

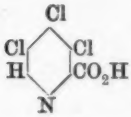
When 2-methylpyridine is subjected to the action of a current of chlorine, the molecule for the most part breaks down and a tarry mass is produced, a similar result being obtained on heating the methylpyridine with phosphorus pentachloride. In these circumstances, recourse was had to the process found successful in the case of pyridine, namely, the chlorination of the hydrochloride saturated with hydrochloric acid. The only solid substance as yet produced as the direct result of chlorination separates as a white, crystalline powder having the formula C_6HCl_6N. This compound is resolved by gently heating with 80 per cent. sulphuric acid into a trichloropicolinic acid, which, on heating with glycerol, gives a trichloropyridine (m. p. 72—73°). Since this trichloropicolinic acid is convertible through its amide by the Hofmann reaction into a trichloroaminopyridine identical with the substance which has been shown (*Trans.*, 1899, **75**, 980; 1900, **77**, 771) to have the constitution represented by the formula



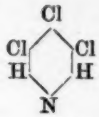
it is clear that the three foregoing substances may be thus represented:



I.



II.



III.

DISCUSSION.

Sir WILLIAM RAMSAY asked whether Mr. Sell had investigated a compound obtained by the action of chlorine on picoline, having a smell of bleaching-powder.

Mr. SELL, in reply, said he had often noticed the substance referred to, but had hitherto found no opportunity of making more than a cursory examination of it. This product is not noticed during the chlorination of picoline hydrochloride, but only when the free base is used.

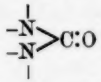
***90. "The absorption spectra of uric acid, murexide, and the ureides, in relation to colour, and their chemical structure." By Walter Noel Hartley.**

The author refers to a former paper (*Trans.*, 1887, **51**, 153) of which this is a continuation. He found it necessary to examine the chemical constitution of murexide, and had made considerable progress in this direction, when work on similar lines was published almost simultaneously by Piloty (Abstr., 1904, i, 820), Möhlau (*ibid.*, p. 654), and Max Slimmer and Stieglitz (*ibid.*, p. 634).

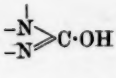
Murexide was prepared from two sources, namely, alloxantin and alloxan, by boiling with alcoholic ammonia for half an hour. Two intermediate products were obtained, the one being colourless with a rich blue fluorescence and a strong absorption band in the ultra-violet, the other a reddish-yellow substance which appears to be purpuric acid, the absorption spectra of which were photographed. The ureides, diureides, and some oxypurin derivatives were spectrographically examined. They are divided into two groups, those which show an absorption band and those which do not.

The former are those oximino-ketones with no ethylenic linking associated with the carbonyl groups. On the other hand, those which have one or more such linkings do show bands; other substances, such as alloxantin and dialuric acid, are capable of undergoing a change under the action of water, and these exhibit a band, that of dialuric acid, being identical with that of alloxantin. Others apparently occur

in isodynamic forms, the change being rendered evident by the development of a band in a solution which at first shows none. Theobromine and caffeine are examples. Whether the substance shows an absorption band or not is apparently determined by the 8th position in the purin ring being occupied by O, OR (where R is an alkyl or monad metal), or by H.



2 : 6 : 8-Oxypurin show spectra with a band.



2 : 6-Oxypurin

6-Oxypurin shows no band.

*91. **"Observations on chemical structure and physical properties associated with the theory of colour."** **By Walter Noel Hartley.**

Owing to certain peculiarities in the absorption spectra of the ureides, the author collates a number of observations on the structure of chromogenic compounds, together with various views regarding the origin of colour in dyes and other substances. Selecting that feature which is common to them all, he seeks to apply it to an explanation of the absorption phenomena generally observed in the aromatic hydrocarbons and their derivatives. The main feature in a coloured substance is the occurrence in two parts of the molecule of ethylenic and benzenoid groupings and of ketonic groupings. The ethylenic and ketonic groupings in a molecule are precisely those admitting of a keto-enolic isodynamic change, which, in accordance with the view of Baly and Desch (*Trans.*, 1904, **85**, 1029), is the cause of selective absorption. According to J. Schmiedlin (*Compt. rend.*, 1904, **139**, 872), the two parts of the molecule of a dye must consist of one endothermic and the other exothermic, the former being chromophoric, the latter an auxochrome. It is pointed out that benzenoid and ethylenic groupings are endothermic, whilst a carbonyl group is exothermic; and also that whilst azobenzene is a yellow chromogen, benzene is also a chromogen, but its colour is in the ultra-violet. The explanation based on the change from a double linking (ketonic) to a single linking (enolic) should, if sound, be capable of explaining the occurrence of six bands in the spectrum of benzene, four in that of naphthalene, and four in that of anthracene.

It is shown how this is possible from Kekulé's formula for benzene, and how this formula may be reconciled with the centric formula.

***92. "Further studies on dihydroxymaleic acid." By Henry John Horstman Fenton.**

The mode of formation, properties, constitution, and relationships of dihydroxymaleic acid have been discussed in several previous communications (*Trans.*, 1894, **65**, 899; 1895, **67**, 48 and 774; 1896, **69**, 546; 1897, **71**, 375; 1902, **81**, 426; *Proc.*, 1898, **14**, 119; *Proc. Camb. Phil. Soc.*, 1901, **11**, 109; 1902, **11**, 358, &c.), and the present paper gives an account of some of the principal investigations which have since been carried out in connection with this subject.

Results of considerable interest have been obtained from a study of the condensation of the acid with ammonia and the behaviour of the acid and its esters towards various hydrazines. Further observations have been made on the conditions of formation of glycollic aldehyde and of mesoxalic semi-aldehyde, and the properties of the latter substance have also been further examined.

***93 "The influence of light on diazo-reactions. Preliminary notice." By Kennedy Joseph Previté Orton and Joseph Edward Coates and (in part) Frances Burdett.**

Although it has long been realised that certain diazo-compounds are sufficiently sensitive to light to render a "diazo-type" photographic process practicable (Feer, D.R.-P. 53455; Green, Cross, and Bevan, D.R.-P. 56606, *Ber.*, 1890, **23**, 3131, and *J. Soc. Chem. Ind.*, 1890, **9**, 1001; and Ruff and Stein, *Ber.*, 1901, **34**, 1668), the precise reactions involved do not appear to have been fully investigated. The experiments appear to have been carried out exclusively with solid diazo-compounds. Green, Cross, and Bevan (*loc. cit.*, and *Ber.*, 1901, **34**, 2495) state that the primary action of light is to effect a decomposition into phenols and nitrogen.

In the case of the highly substituted diazobenzenes, which are quite stable at the ordinary temperature, the effect of light as an accelerator of certain reactions can be easily studied. The reactions are well illustrated in the remarkable behaviour of *s*-tribromodiazobenzene. On boiling aqueous or acid solutions of *s*-tribromobenzenediazonium salts, no *s*-tribromophenol is formed (Silberstein, *J. pr. Chem.*, 1883, [ii], **27**, 113; Hantzsch, *Ber.*, 1900, **33**, 2517). It has been shown, on the contrary (Orton, *Trans.*, 1902, **83**, 802), that the chief reaction is the elimination of bromine and the formation of dibromoquinonediazide. When aqueous solutions of the diazonium salts are exposed to sunlight, a rapid decomposition into *s*-tribromophenol and nitrogen occurs. The addition of acid has no retarding effect on the rate of the

decomposition, but rather increases the yield of *s*-tribromophenol. In the absence of excess of acid, a secondary reaction, the elimination of bromine and the formation of quinonediazide, becomes noticeable (compare Orton, *loc. cit.*).

The corresponding *s*-tribromobenzenediazotates, on the other hand, are entirely unaffected by sunlight.

Not only are the solutions in water very sensitive to light, but also the solutions in methyl and ethyl alcohols and acetic acid are similarly easily decomposed. *s*-Tribromobenzenediazonium salts are remarkable in that their solutions in methyl and ethyl alcohols and in acetic acid yield, on boiling, only *s*-tribromobenzene, and no *s*-tribromoanisole, *s*-tribromophenetole, or *s*-tribromophenyl acetate respectively. In the decompositions effected by sunlight, on the other hand, the main product of the reaction is the methyl or ethyl ether, the anisole, $C_6H_2Br_3 \cdot OMe$, and the phenetole, $C_6H_2Br_3 \cdot OEt$, when methyl or ethyl alcohol are the solvents. The solution in acetic acid yields *s*-tribromophenyl acetate, $C_6H_2Br_3 \cdot OAc$. That the light has a specific accelerating influence on these particular decompositions, is shown by the fact that a solution of the diazonium sulphate in 90 per cent. alcohol, which slowly decomposes at the ordinary temperature, yields only *s*-tribromobenzene in the absence of light, but a large proportion of the phenetole when exposed to sunlight. A solution of potassium *s*-tribromobenzenediazotate in methyl alcohol is unaffected by light. The presence of acids and of water in the alcoholic solution has a marked effect on the course of the reaction.

A number of diazonium salts and diazotates have been investigated, similar effects being observed in each case. Solutions of diazonium salts have been kept for many weeks (10) in the dark without the evolution of a measurable volume of nitrogen; on exposure to sunlight, a rapid change into the corresponding phenol ensues. An interesting example is found in the case of 5-bromo-*m*-xylene-4-diazonium hydrogen sulphate, which is quite stable in aqueous solution at the ordinary temperature so long as light is excluded, but decomposes rapidly either on exposure to light or on heating into the corresponding xylenol.

The results lead the authors to conclude that the conversion of diazo-compounds into phenols, ethers, and phenylacetates is a reaction characteristic of the diazonium ion.

Discussion.

Dr. Cain congratulated Professor Orton on having discovered a method of obtaining certain phenols from the corresponding diazo-salts, which in many cases did not undergo the usual decomposition on

boiling with either dilute or strong acids. He took exception, however, to Dr. Orton's statement that the diazo-salt from *s*-tribromoaniline yielded no phenol when boiled with acids, for although several observers had also recorded their failures to detect any tribromophenol, he had, by adopting the method described in D.R.-P. 95339, which consisted in dropping the diazo-solution into a boiling mixture of sodium sulphate and dilute sulphuric acid, succeeded in obtaining a small yield (2 per cent.) of tribromophenol. He had also noticed that a solution of benzenediazonium chloride on exposure to sunlight deposited a thick, brownish-yellow precipitate in a very short time, whilst another portion of the same solution kept in the dark remained perfectly clear.

Professor Orton, in reply, said that they had failed to obtain *s*-tribromophenol by Heinichen's method (*Annalen*, 1889, **253**, 281), namely, by heating with 63 per cent. sulphuric acid (b. p. 150°), but they had not tried heating in a concentrated solution of sodium sulphate.

***94. "Behaviour of solutions of propyl alcohol towards semi-permeable membranes." By Alexander Findlay and Frederick Charles Short.**

Some years ago, S. U. Pickering stated (*Ber.*, 1891, **24**, 3639) that when a porous pot containing a 57 per cent. aqueous solution of propyl alcohol was immersed in either pure water or pure propyl alcohol, the water or the alcohol passed inwards to the solution. Pickering, therefore, ascribed osmotic pressure to the permeability of the membrane for either of the pure components and its impermeability for the hydrate formed in the solution.

The authors have sought, with the use both of porous pots and of copper ferrocyanide membranes, to repeat Pickering's experiments, but they have in no case obtained any indication confirmatory of this observer's results. When simple porous pots were used, the level of the liquid in the manometer tube attached to the porous pot fell in each case, no matter whether the surrounding liquid was water or propyl alcohol. When a copper ferrocyanide membrane was employed, a rise of liquid in the manometer tube was obtained when the pot was surrounded by water, but a fall occurred when the pot was placed in propyl alcohol.

It is conceivable that the behaviour observed by Pickering might be due to differences in the velocity of diffusion of the pure liquids and the solution, but in this case the rise of liquid obtained could only have been temporary, and the experiment would then lose all its significance for the problem of solution.

Discussion.

Mr. Pickering stated that he could give no further details of his experiment than those which had already been published. There appeared to be no doubt as to the fact observed by him, for the observation was repeated several times. The porous pot used had no semi-permeable diaphragm, but it was only in the case of comparatively impervious pots that the phenomena were apparent; if the pot was too porous, the excess of pressure was not maintained. The result might have been due to ordinary diffusion, but that would not invalidate the explanation given of it.

Dr. Findlay, in reply, said that it would appear that the rise of liquid which Professor Pickering had observed in the manometer was only a temporary one, and that, consequently, the explanation which the authors offered of the discrepancy between the two results is the correct one.

95. "The thermal decomposition of formaldehyde and acetaldehyde." By William Arthur Bone and Henry Llewellyn Smith.

The authors show that at all temperatures between 400° and 1125° formaldehyde rapidly decomposes, without any separation of carbon, in accordance with the equation $CH_2O = CO + H_2$, and that the decomposition is not, to any appreciable extent, reversible. At high pressures (concentrations), the simple decomposition may be masked by more complex changes.

At 400°, acetaldehyde decomposes without any separation of the carbon or liberation of hydrogen, in accordance with the equation $CH_3{\cdot}CHO = CH_4 + CO$, but at 600° and higher temperatures carbon and hydrogen appear among the products. The effect of a hot surface of porous porcelain, at 450—500°, on the undiluted aldehyde vapour, in absence of oxygen, is to induce the "aldol condensation" with formation of crotonaldehyde and steam.

96. "The synthesis of formaldehyde." By David Leonard Chapman and Alfred Holt, jun.

The authors have succeeded in synthesising formaldehyde by maintaining a platinum wire at a high temperature in the following mixtures: (*a*) carbon monoxide and hydrogen; (*b*) carbon monoxide, hydrogen, and steam; (*c*) carbon monoxide and steam; (*d*) carbon dioxide and hydrogen. All attempts to obtain formaldehyde in appreciable quantities by passing the same gaseous mixtures through heated tubes at temperatures below 500° were unsuccessful.

97. "Oxymercuric perchlorates and the action of alcohol on mercury perchlorates." By Masumi Chikashigé.

Three new oxymercuric perchlorates are described, making four altogether, with that previously described (*Proc.*, 1895, **11**, 164). (1) *Hydrated oxymercuric perchlorate*, $OHg_3(ClO_4)_4,12H_2O$, crystallising from its cold aqueous solution and decomposing in its boiling solution; (2) the same salt, that is, $\frac{1}{3}$-*basic oxymercuric perchlorate*, rendered anhydrous by boiling alcohol and thereby greatly altered in stability; (3 and 4) two isomeric $\frac{2}{3}$-*basic oxymercuric perchlorates*, $O_2Hg_3(ClO_4)_4$, differing greatly from each other, although both are anhydrous. The α-salt, described in the previous paper, is non-explosive, whereas the β-salt, obtained by heating the $\frac{1}{3}$-basic salt in boiling alcohol, is a powerfully detonating substance.

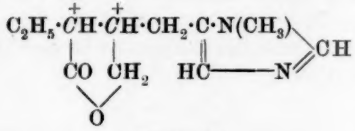
Mercuric perchlorate interacts with boiling alcohol to form mercurous perchlorate, perchloric acid, and aldehyde. The $\frac{1}{3}$-basic salt is partly reduced to mercurous salt by boiling with alcohol, and partly decomposes into perchloric acid and the β-$\frac{2}{3}$-basic oxymercuric salt (insoluble in acids). No reduction of perchloric acid occurs, and no trace of chloride is formed.

98. "The constitution of pilocarpine. Part V. Conversion of *iso*pilocarpine into pilocarpine." By Hooper Albert Dickinson Jowett.

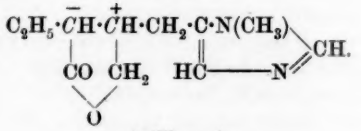
The author discussed the question as to the relationship between pilocarpine and *iso*pilocarpine, and showed that the evidence on the whole favoured the view that the alkaloids were stereoisomerides. The views of Pinner on this subject (*Ber.*, 1905, **38**, 1570), namely, that the isomerism is not solely stereochemical, but structural, were shown to be open to objection. It was shown that if the alkaloids were stereoisomerides, *iso*pilocarpine should be capable of conversion into pilocarpine by the same reagent which converts pilocarpine into *iso*-pilocarpine, whereas if they were structural isomerides this conversion would not take place.

By heating pure *iso*pilocarpine, shown to be free from pilocarpine, with alcoholic potash, a mixture was obtained from which 80 per cent. of pure *iso*pilocarpine was separated, and from the mother liquors, after recrystallisation and conversion into the hydrochloride, a small quantity of pure pilocarpine was isolated. The identity of the latter was proved by the formation of the hydrochloride (m. p. 201°, $[\alpha]_D$ +92·8°) and of the nitrate (m. p. 177—178°).

It was thus shown that the alkaloids are almost certainly stereo-isomerides, and may be represented by the following formula:



Pilocarpine.



*iso*Pilocarpine.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bloxam, W. Popplewell, and Leake, H. M., with the assistance of R. S. Finlow. An account of the research work in indigo, carried out at Dalsingh Serai Research Station (*under subsidy of the Government of Bengal*) from 1903 to March 1904. pp. 45 + lxxxix. Calcutta 1905. (*Recd.* 16/5/05.) From the Authors.

Meldrum, Andrew N. Avogadro and Dalton. The standing in chemistry of their hypotheses. With a preface by Francis R. Japp. pp. 113. Edinburgh 1904. (*Recd.* 17/5/05.) From the Author.

Russell, J. B., and Bell, A. H. Notes on volumetric analysis. pp. viii + 94. ill. London 1905. (*Recd.* 15/5/05.)
From the Publisher.

II. *By Purchase.*

Harbord, F. W. The metallurgy of steel. With a section on the mechanical treatment of steel, by J. W. Hall. Second edition. pp. xxiv + 768. ill. London 1905. (*Recd.* 11/5/05.)

Kayser, H. Handbuch der Spectroscopie. Band III. pp. viii + 604. ill. Leipzig 1905. (*Recd.* 1/5/05.)

Traube, J. Grundriss der physikalischen Chemie. pp. viii + 360. ill. Stuttgart 1904. (*Recd.* 8/5/05.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, June 5th, 1905.

At the next Meeting, on **Thursday**, June **1st**, 1905, at **8** p.m., the following papers will be communicated :

"The constituents of the seeds of *Hydnocarpus Wightiana* and of *Hydnocarpus Anthelmintica*. Isolation of a homologue of chaulmoogric acid." By F. B. Power and M. Barrowcliff.

"The constituents of the seeds of *Gynocardia Adorata*." By F. B. Power and M. Barrowcliff.

"The relation of ammonium to the alkali metals. A study of ammonium, magnesium, and ammonium zinc sulphates and selenates." By A. E. H. Tutton.

"Camphorylazoimide." By M. O. Forster and H. E. Fierz.

"Diazo-derivatives of the mono-acylated aromatic para-diamines." By G. T. Morgan and F. M. G. Micklethwait.

"Influence of substitution on the formation of diazoamines and aminoazo-compounds. Part III. Azo-derivatives of disubstituted aromatic meta-diamines." By G. T. Morgan and W. O. Wootton.

"The significance of optical properties as connoting structure : camphorquinone-hydrazones-oximes ; a contribution to the chemistry of nitrogen." By H. E. Armstrong and W. Robertson.

"Solubility as a measure of the change undergone by isodynamic hydrazones. (1) Camphorquinonephenylhydrazone. (2) Acetaldehydephenylhydrazone." By W. Robertson.

"The design of gas-regulators for thermostats." By T. M. Lowry.

"The constitution of barbaloin. Part I." By H. A. D. Jowett and C. E. Potter.

"Influence of substitution on the formation of diazoamines and aminoazo-compounds. Part IV. 5-Bromo-*as*(4)-dimethyl-2 : 4-diaminotoluene." By G. T. Morgan and A. Clayton.

"The action of hypobromous acid on piperazine." By F. D. Chattaway and W. H. Lewis.

"The action of magnesium methyl iodide on pinene nitrosochloride." By W. A. Tilden and J. A. Stokes.

"Racemisation phenomena during the hydrolysis of optically active menthyl and bromyl esters by alkali." By A. McKenzie and H. B. Thompson.

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Issued 9/6/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 297.

Thursday, June 1st, 1905, Professor R. MELDOLA, F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs. :

Bryce Chudleigh Burt, B.Sc., Port of Spain, Trinidad, B.W.I.
Joseph Morgan Davey, Shetone House, Briton Ferry, Glam.
Herbert Drake Law, B.Sc., 152, Brixton Road, S.W.
Thomas Rigby, 23, The Square, Fairfield, Manchester.
Arthur Gough Ruston, B.A., B.Sc., 244, Oxford Road, Reading.

Of the following papers, those marked * were read :

*99. **"The constituents of the seeds of *Hydnocarpus Wightiana* and of *Hydnocarpus anthelmintica*. Isolation of a homologue of chaulmoogric acid." By Frederick Belding Power and Marmaduke Barrowcliff.**

The fatty oils from the seeds of *Hydnocarpus Wightiana* (Blume) and *H. anthelmintica* (Pierre) have long been used in Western India and in China respectively for the same medicinal purposes for which chaulmoogra oil is employed. In view of this fact and of the interesting results obtained during the investigation of chaulmoogra seeds, from *Taraktogenos Kurzii*, King (Power and Gornall, *Trans.*, 1904, 85, 838),

the authors have examined the seeds of these two species of *Hydnocarpus* with especial regard to the constituents of their fatty oils.

The seeds of *H. Wightiana* yielded, on expression, 32·4 per cent., and by extraction with ether 41·2 per cent. of oil. The expressed oil had the following characters: m. p. 22—23°; sp. gr. 0·958 at 25°; $[\alpha]_D$ +57·7° in chloroform; acid value, 3·8; saponification value, 207; iodine value, 101·3.

The seeds of *H. anthelmintica* gave, on expression, 16·3 per cent., and by extraction with ether 17·6 per cent. of oil. The expressed oil had the following characters: m. p. 24—25°; sp. gr. 0·953 at 25°; $[\alpha]_D$ +52·5° in chloroform; acid value, 7·5; saponification value, 212; iodine value, 86·4.

The authors found that these two oils very closely resemble chaulmoogra oil (from *Taraktogenos Kurzii*) both in physical characters and in composition, consisting chiefly of the glyceryl esters of chaulmoogric acid, $C_{18}H_{32}O_2$, and a lower homologue of the same series, which was isolated from both oils and also from chaulmoogra oil. The new acid has the formula $C_{16}H_{28}O_2$, and is designated *hydnocarpic acid*; it crystallises from alcohol in glistening leaflets, melting at 60°, and having $[\alpha]_D$ +68° in chloroform. It is an unsaturated acid, containing only one ethylenic linking, and therefore possesses a closed carbon ring.

Methyl hydnocarpate, $C_{15}H_{27}\cdot CO_2Me$, is a colourless oil, which boils at 200—203° (corr.)/19 mm., and solidifies when cooled, forming crystals which melt at 8°. It has $[\alpha]_D$ +62·4° in chloroform. *Ethyl hydnocarpate*, $C_{15}H_{27}\cdot CO_2Et$, boils at 211° (corr.)/19 mm., is a colourless oil, and has $[\alpha]_D$ +51·6° in chloroform. *Hydnocarpamide*, $C_{15}H_{27}\cdot CO\cdot NH_2$, forms needles from alcohol. It melts at 112—113° and has $[\alpha]_D^{20°}$ +70·2° in chloroform.

The oil of *Hydnocarpus Wightiana* appears to contain, besides the above-mentioned acids, a very small proportion of an acid or acids belonging to the linolic or linolenic series. The oil of *Hydnocarpus anthelmintica*, on the other hand, contains, as minor constituents, small amounts of oleic and palmitic acids.

*100. "The constituents of the seeds of *Gynocardia odorata*."

By Frederick Belding Power and Marmaduke Barrowcliff.

Prior to the year 1900 it was generally believed that the chaulmoogra oil of commerce was obtained from the seeds of *Gynocardia odorata* (R.Br.). More recently, however, it has been recorded by Mr. E. M. Holmes (*Pharm. J.*, 1900, **64**, 522; 1901, **66**, 596), on the authority of Dr. Prain, Director of the Botanic Survey of India, that chaulmoogra oil is afforded by the seeds of *Taraktogenos Kurzii* (King), these seeds having evidently been wrongly referred to the

genus *Gynocardia*. Moreover, one of the authors and Mr. F. H. Gornall (*Trans.*, 1904, **85**, 838) have shown that the oil from authentic *Taraktogenos* seeds is identical in physical character and composition with the chaulmoogra oil of commerce. The authors now state conclusively that the oil known in European commerce as "chaulmoogra oil," and sometimes as "gynocardia oil," could never have been obtained from the seeds of *Gynocardia odorata*, since the oil from these seeds, at the ordinary temperature, is a liquid, whereas chaulmoogra oil is solid (m. p. 22—23°). Furthermore, chaulmoogra oil is optically active and consists chiefly of the glyceryl esters of acids of the chaulmoogric series (compare Power and Gornall, *loc. cit.*, and the preceding abstract), whereas the oil from *Gynocardia* seeds is optically inactive and contains neither chaulmoogric acid nor its homologues.

The seeds of *Gynocardia odorata* used in this investigation were collected in Sylhet, Assam, and were of undoubted genuineness. They yielded, on expression, 19·5 per cent., and by extraction with ether 27·2 per cent. of oil, which had a light yellow colour and an odour like that of linseed oil. The expressed oil had the following characters: sp. gr., 0·925 at 25°; acid value, 4·9; saponification value, 197; iodine value, 152·8. It was found to consist of the glyceryl esters of the following acids: (1) linolic acid, or isomerides of the same series, constituting the largest proportion of the oil; (2) palmitic acid in considerable amount; (3) linolenic and *iso*linolenic acids, the latter preponderating; and (4) oleic acid in relatively small amount.

In addition to the fatty oil, *Gynocardia* seeds contain, as has previously been shown (Power and Lees, *Trans.*, 1905, **87**, 349), 5 per cent. of a crystalline cyanogenetic glucoside, gynocardin,

$$C_{13}H_{19}O_9N,1\tfrac{1}{2}H_2O,$$

and a hydrolytic enzyme, gynocardase.

***101. "The relation of ammonium to the alkali metals. A study of ammonium magnesium and ammonium zinc sulphates and selenates." By Alfred Edwin Howard Tutton.**

The results of this investigation are remarkably similar to those previously published (*Trans.*, 1903, **83**, 1049) for ammonium sulphate and its relations to the analogous sulphates of potassium, rubidium, and cæsium, and the following conclusions have been deduced.

With regard to the three properties which refer to the fundamental structural unit of the crystals, namely, the molecular volume, the topic axes (the relative distances apart, along the three crystallographical axes, of the centres of contiguous structural units), and the molecular refraction, it is shown that the ammonium salt of any double salt group of the series behaves almost exactly like the

rubidium salt. The same was previously shown to be true of ammonium sulphate in the simple salt series.

With respect to the properties of the crystals themselves, they resolve themselves into two classes. Those of the one category follow the order of the molecular weights, and include the densities, the rotation of the optical ellipsoid about the symmetry axis of the crystals, and the specific refraction and dispersion. In those of the other class, the ammonium salt occupies positions varying from one quite close to the rubidium salt to another nearer to the cæsium salt, and to this class belong the interfacial angles, the monoclinic axial angle, the three refractive indices (corresponding to the three axes of the optical ellipsoid), the mean refractive index for the whole crystal, the double refraction, and the axial ratios of the optical ellipsoid.

These definite results afford ample scope for speculation as to the spacial conditions which permit of the replacement of two atoms of the alkali metal potassium by ten atoms of the two ammonium groups, with no more effect on the crystallographical characters and on the dimensions and properties of the structural unit than if a mere exchange for two other analogous metallic atoms had occurred.

***102. "Camphorylazoimide." By Martin Onslow Forster and Hans Eduard Fierz.**

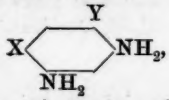
Camphorylazoimide, $C_8H_{14}<\begin{matrix}CH\cdot N_3\\ |\\ CO\end{matrix}$, precipitated from a solution of camphoryl-ψ-semicarbazide nitrate by sodium nitrite, crystallises from alcohol in long, flattened, transparent prisms, which retain their lustre when protected from light, becoming opaque on exposure to sunlight during a few minutes; it melts at 67°, is volatile in steam, and decomposes on heating without explosion. Concentrated sulphuric acid, alcoholic alkali hydroxides, and an acid solution of stannous chloride liberate two-thirds of the nitrogen quantitatively, and reduction with zinc and acetic acid converts the substance into aminocamphor.

α-Iminocamphor, $C_8H_{14}<\begin{matrix}C:NH\\ |\\ CO\end{matrix}$, produced when alcoholic ammonia and alkalis act on the azoimide, is an unstable solid, which rapidly undergoes decomposition on exposure to air. Dilute acids resolve it quantitatively into ammonia and camphorquinone, whilst bornylcarbimide converts it into the stable *carbamide*,

$$C_8H_{14}<\begin{matrix}C:N\cdot CO\cdot NH\cdot C_{10}H_{17}\\ |\\ CO\end{matrix}.$$

***103. "Influence of substitution on the formation of diazoamines and aminoazo-compounds. Part III. Azo-derivatives of the symmetrically disubstituted primary meta-diamines." By Gilbert Thomas Morgan and William Ord Wootton.**

In 1902, one of the authors showed, from a study of three primary meta-diamines having the general formula



that these substances yield azo-derivatives, although much less readily and in smaller yield than those meta-diamines containing a free para-position with respect to one of the amino-groups. This investigation has now been extended to a larger series of these bases containing chlorine, bromine, iodine, and nitroxyl substituents, and the results obtained lead to the following conclusions: (1) the course of the condensation is not materially affected by an increase in the atomic weight of the halogen substituent, although the colour of the azo-compound deepens considerably; (2) the yield of the azo-derivative is greatly increased when a nitro-group is present in the nucleus of the diazonium salt, and to a less extent when this substituent is present in the molecule of the diamine.

The following new diamines have been prepared and characterised: 6-*chloro*-4-*nitro*-m-*phenylenediamine*, 6-*bromo*-4-*nitro*-m-*phenylenediamine*, and *di-iodo*-m-*phenylenediamine*.

***104. "Diazo-derivatives of monoacylated aromatic para-diamines." By Gilbert Thomas Morgan and Frances Mary Gore Micklethwait.**

The authors having previously observed that benzenesulphonyl-*p*-phenylenediamine and camphor-*β*-sulphonyl-*p*-phenylenediamine when treated with nitrous acid yield diazo-anhydrides of the type $C_6H_4\langle{}^{N\cdot SO_2R}_{N:N}$, now show that this condensation occurs with other aromatic para-diamines, and *benzenesulphonyl*-2 : 5-*tolylenediazoimide*, *benzenesulphonyl*-2 : 5-p-*xylylenediazoimide*, and *benzenesulphonyl*-1 : 4-*naphthylenediazoimide* have been prepared.

A study of the diazo-derivatives of other monoacylated para-diamines indicates that the formation of similar cyclic diazoimides does not occur with the formyl, acetyl, succinyl, and benzoyl derivatives of *p*-phenylenediamine. From the first two members of this series, ill-defined nitrosoamines of the type $R\cdot CO\cdot NH\cdot C_6H_4\cdot NH\cdot NO$ have

been produced, whilst benzoyl-*p*-phenylenediamine, when diazotised and treated with cold aqueous potassium carbonate, yields a remarkably stable diazonium carbonate, $C_6H_5\cdot CO\cdot NH\cdot C_6H_4\cdot N_2\cdot HCO_3$. This substance, which is very sparingly soluble in water, dissolves with effervescence in cold dilute mineral acids, readily condenses to form azo-derivatives with phenols and aromatic amines, and when boiled with acidified water yields benzoyl-*p*-aminophenol (m. p. 205—207°).

Benzoyl-*p*-phenylenediamine also gives rise to a sparingly soluble yellow diazonium nitrite, $C_6H_5\cdot CO\cdot NH\cdot C_6H_4\cdot N_2\cdot NO_2$, which readily yields azo-derivatives.

Discussion.

The President congratulated the authors on having, as far as he knew, been the first to isolate in a definite solid form a diazonium carbonate and nitrite. In many diazo-decompositions, and notably in the transformation of β-naphthylamine into β-nitronaphthalene, it was necessary to assume the intermediate formation of a diazonium nitrite, but such a salt had not hitherto been isolated.

***105. "The significance of optical properties as connoting structure: camphorquinone—hydrazones—oximes; a contribution to the theory of the origin of colour and to the chemistry of nitrogen." By Henry E. Armstrong and William Robertson.**

The authors discuss the significance of optical properties generally with reference to the structure of camphorquinone and the oximes and hydrazones derived therefrom; they apply the conclusions arrived at to the general problems of the connection between optical attributes and structure, ultimately expressing the view that there is not a tittle of proof in support of the Hantzsch-Werner hypothesis of isomerism among nitrogen compounds. Several new "hydrazones" are described.

Discussion.

Dr. Lapworth said that Mr. Hann and he had not intended to offer any definite expression of opinion as to the correctness of Betti's formulæ for the isomeric hydrazones of camphorquinone, although they had certainly not avoided giving the impression that they approved of them.

In reality, his own opinion had been, firstly, that the substance melting at 180° was the true hydrazone

$$\left(\text{"hydrazonone,"}\ C_8H_{14}\!<\!\begin{matrix}C{:}N_2HPh\\ |\\ CO\end{matrix}\right),$$

and that the ferric chloride coloration it affords was due to an impurity

not easily removed, and secondly that the products of change were one or both of the two stereoisomeric "azones" ($C_8H_{14}<^{CH\cdot N:NPh}_{CO}$).

However, as he and his colleague could not shake Betti's evidence nor adduce any direct evidence in favour of the other view, they did not find fault with this investigator's formulæ and adopted the terms first used by him.

***106. "Solubility as a measure of the change undergone by isodynamic hydrazones. (1) Camphorquinonephenylhydrazone, (2) acetaldehydephenylhydrazone." By William Robertson.**

The applicability of the method of determining the variation in solubility with time as a means of estimating the proportions of isodynamic substances in solution has been further shown by extending the investigation to hydrazones. The relative proportion present in the equilibrate mixture in the case of the phenylhydrazone of camphorquinone is found to be about 9 : 1.

***107. "The design of gas-regulators for thermostats." By Thomas Martin Lowry.**

Tests are described of seven different regulators. Two new patterns are described. By means of one of these the temperature of a bath of water may be maintained within $\pm 0{\cdot}01°$ during several weeks, the average fluctuation being about $\pm 0{\cdot}002°$.

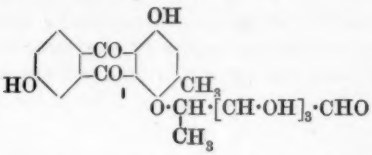
Discussion.

Sir W. Ramsay suggested the use of a Bourdon gauge tube and a small-sized regulator.

***108. "The constitution of barbaloin. Part I." By Hooper Albert Dickinson Jowett and Charles Etty Potter.**

The authors reviewed the previous work on this subject, and showed that there exist two very different views as to the empirical formula of barbaloin. The older formula, $C_{16}H_{18}O_7$, proposed by Tilden in 1875 (or the very slightly different one, $C_{16}H_{16}O_7$, of Groenewald) has been generally accepted until quite recently, when Léger, in 1902,

adopted the formula $C_{21}H_{20}O_9$, and suggested that the constitution of barbaloin might be represented as follows:



The more recent work of Aschan has tended to confirm the older formula, $C_{16}H_{18}O_7$, rather than that of Léger.

The authors have made a number of analyses and molecular weight determinations of carefully purified barbaloin and tribromobarbaloin, and their results agree best with Tilden's formula. They have been unable to confirm Léger's statements respecting the decomposition of barbaloin with sodium peroxide, but have proved the correctness of Oesterle's results.

Tetra-acetyltribromobarbaloin, $C_{24}H_{23}O_{11}Br_3$, which was obtained in well-defined yellow needles, melts at 135°.

Tribromobarbaloin, and probably barbaloin, therefore, contain four hydroxyl groups. A number of experiments on the action of various reagents on barbaloin and tribromobarbaloin were recorded.

Discussion.

Professor Tilden remarked that much of the confusion existing in the work by earlier investigators of aloin arose from the fact that it was not fully recognised that the crystalline substances obtained from the several varieties of the drug were not identical. About 1870 this confusion began to be cleared away, and he believed that he was responsible for the application of the names barbaloin, socaloin, &c., to the several substances then recognised as distinct. The mistaken idea that the aloins are glucosides probably arose from the fact that most of them reduce Fehling's solution. He did not propose to resume the study of these substances, but wished success to Dr. Jowett and his colleague in their investigation.

***109. "Influence of substitution on the formation of diazoamines and aminoazo-compounds. Part IV. 5-Bromo-*as*(4)-dimethyl-2:4-diaminotoluene." By Gilbert Thomas Morgan and Arthur Clayton.**

The base, 5-bromo-*as*(4)-dimethyl-2:4-diaminotoluene (m. p. 40°), has been prepared with the object of investigating the action of diazonium salts on a partially alkylated meta-diamine containing substituents in

the two para-positions with respect to the aminic nitrogen. The orientation of the substituents in this diamine was determined by preparing the substance by the following alternative methods:

(1) Dimethyl-*p*-toluidine was converted into 2-nitrodimethyl-*p*-toluidine, and this compound, when successively reduced, acetylated, and brominated, yielded an *acetylbromo*-as(4)-*dimethyl*-2:4-*diaminotoluene* (m. p. 163°), from which the bromodiamine was isolated and further characterised by the preparation of its *benzoyl* and *benzenesulphonyl* derivatives.

(2) 3-Bromo-*p*-toluidine was successively nitrated and methylated, when a tertiary amine, $CH_3 \cdot C_6H_2Br(NO_2) \cdot N(CH_3)_2$, was obtained, which on successive reduction and acylation gave rise to acyl derivatives identical with those produced by the foregoing method, and from which the same bromodiamine was produced on hydrolysis.

This base interacts with diazo-compounds only with difficulty; it gives an azo-dye on fabrics impregnated with diazotised primulin, but does not yield crystallisable azo-derivatives with the simpler diazonium salts.

***110. "The action of magnesium methyl iodide on pinene nitrosochloride." By William Augustus Tilden and Joseph Arthur Stokes.**

The Grignard reagent attacks partly the chlorine of the nitrosochloride and partly the oxygen of the nitroso-group, substituting in each case an equivalent quantity of methyl. Two principal products are therefore obtained, namely, the oxime, $C_{10}H_{15}(CH_3){:}NOH$ (m. p. 193°), and a base, $C_{10}H_{16}ClN(CH_3)_2$ (m. p. 122°). The oxime possesses well-marked basic properties and forms a crystallisable hydrochloride. The chlorine present in the base is not exchangeable for methyl by the further action of the reagent, but when treated with alcoholic potash it loses the elements of hydrogen chloride and produces an unsaturated base, $C_{10}H_{16}N(CH_3)_2$ (m. p. 112°), which is identical with dimethylpinylamine. Benzoyl and methyl ethers of the oxime are described in the paper as well as the hydrochlorides and other salts of the saturated chloro-base, of the unsaturated base derived from it, and of dimethylpinylamine prepared from pinylamine.

111. "The action of hypobromous acid on piperazine." By Frederick Daniel Chattaway and William Henry Lewis.

The *N*-dichloro-derivative of piperazine was described several years ago, but the corresponding bromine compound has not hitherto been prepared, owing probably to the circumstance that the action of

hypobromous acid in excess on piperazine gives rise, not as usual to the substituted nitrogen bromide, but to an additive product of hypobromous acid and the base. The additive product, which is insoluble in water and chloroform, and rapidly decomposes on keeping, yields, however, diethylene dibromodiamine, $BrN(CH_2 \cdot CH_2)_2NBr$, on treatment with an aqueous solution of the base. It crystallises from chloroform, in which it is easily soluble, in yellow, short, flattened prisms. On heating, it explodes with great violence at 79—80° without previously melting.

112. "Racemisation phenomena during the hydrolysis of optically active menthyl and bornyl esters by alkali." By Alexander McKenzie and Herbert Bryan Thompson.

A number of inactive acids were converted into their *l*-menthyl and *l*-bornyl esters respectively and the latter then submitted to fractional hydrolysis by being heated first with an amount of alkali insufficient for complete hydrolysis, whilst the mixture of esters, which survived the attack of the alkali in the initial hydrolysis, was then hydrolysed by an excess of alkali. In several cases, optically active acids of the same sign were obtained as products both of the initial and final hydrolysis. The results are indicated as follows :

	Direction of rotation of the acid from the initial hydrolysis.	Direction of rotation of the acid from the final hydrolysis.
l-Menthyl *dl*-phenylethoxyacetate ...	−	−
l-Bornyl *dl*-phenylethoxyacetate ...	−	−
l-Bornyl *dl*-mandelate	−	inactive
l-Bornyl *dl*-lactate	inactive	−
l-Menthyl *dl*-lactate	+	−
l-Menthyl *dl*-α-ethoxypropionate ...	−	+
l-Bornyl *dl*-α-ethoxypropionate	+	−

No resolution was effected with *l*-menthyl *dl*-α-hydroxybutyrate, *l*-bornyl *dl*-α-hydroxybutyrate, and *l*-menthyl *dl*-β-hydroxybutyrate respectively.

The racemising effect of alkali during the hydrolysis of the esters examined is discussed.

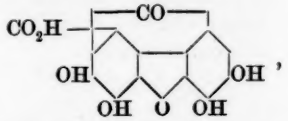
The fractional esterification of *i*-phenylethoxyacetic acid by *l*-borneol, the esterification of *l*-mandelic acid by *l*-borneol, the action of potassium hydroxide on *l*-malic acid, and the action of heat on the isomeric *l*-menthyl mandelates were investigated.

113. "**Estimation of hydrogen peroxide in the presence of potassium persulphate.**" **By John Albert Newton Friend.**

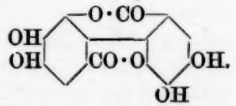
The author has already shown (*Trans.*, 1904, **85**, 597) that hydrogen peroxide cannot be correctly estimated in ordinary circumstances by titration with potassium permanganate in the presence of potassium persulphate. The amount of permanganate required always falls short of the theoretical. The author now shows that if a slight excess of permanganate is rapidly added from a burette to the mixture of peroxide and persulphate, and the excess of permanganate estimated iodometrically with thiosulphate, very accurate results may be obtained in the presence of any weight of potassium persulphate not exceeding 0·08 gram.

114. "**Some oxidation products of the hydroxybenzoic acids and the constitution of ellagic acid.**" **By Arthur George Perkin and Maximilian Nierenstein.**

When gallic acid dissolved in sulphuric acid is treated with potassium persulphate with or without boric acid, *ellagic acid*, $C_{14}H_6O_8$, is formed (yield 67 per cent. approximately), a substance to which Goldschmidt and Barth (*Ber.*, 1879, **12**, 1237) and Goldschmidt and Jahoda (*Monatsh.*, 1892, **13**, 51) gave the constitution



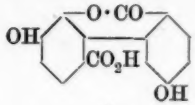
but which Graebe (*Ber.*, 1903, **36**, 212) considers is more probably



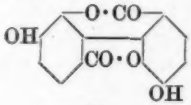
Tetra-acetylellagic acid, $C_{14}H_2O_8(C_2H_3O)_4$, sinters at about 305° and melts at 313—316°. Protocatechuic acid, in a similar manner, gives a compound, $C_{14}H_6O_6$, probably identical with Schiff's catellagic acid (*Ber.*, 1882, **15**, 2590), which he prepared by means of arsenic acid and for which he suggested either of the formulæ $C_{14}H_{10}O_7$ and $C_{14}H_8O_7$. This compound was obtained by the author as minute, colourless needles, melting above 360°, subliming at higher temperatures, and gave the *diacetyl* derivative, $C_{14}H_4O_6(C_2H_3O)_2$ (prismatic needles, m.p. 322—324°).

On distillation with zinc dust, it resembles ellagic acid in giving flourene.

From the product of the oxidation of *p*-hydroxybenzoic acid in the same manner, *catellagic acid*, $C_{14}H_8O_6$ (colourless, silky needles, m. p. above 360°), and a trace of protocatechuic acid have been isolated. The substance $C_{14}H_8O_6$ gives a *diacetyl* compound, $C_{14}H_6O_6(C_2H_3O)_2$ (long, colourless needles, m. p. 267—268°), and yields flourene on distillation with zinc dust, and by fusion with alkali two compounds, probably acids, which are still under examination. To this compound, $C_{14}H_8O_6$, which appears to result from the interaction of *p*-hydroxybenzoic acid and protocatechuic acid, the constitution (I)



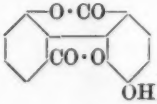
I.



II.

is assigned, from which that of catellagic acid follows (II). By analogy, ellagic acid can be similarly formulated, pointing strongly to the correctness of Graebe's suggestion (*loc. cit.*).

When oxidised by this method, *m*-hydroxybenzoic acid gives a complex mixture of yellow, crystalline substances and a yellow dyestuff not yet obtained crystalline, but there is also present a compound $C_{14}H_6O_5$ (colourless needles, m. p. 273—276°), subliming at higher temperatures, which is termed *metellagic acid*. The *monoacetyl* derivative, $C_{14}H_5O_5 \cdot C_2H_3O$ (colourless leaflets, m. p. 269—271°), has been prepared, and by distillation with zinc dust a hydrocarbon resembling *flourene* is produced. The constitution

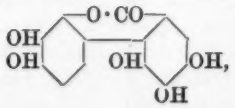


is assigned to this substance.

By the action of caustic potash on ellagic acid, Barth and Goldschmidt (*loc. cit.*) obtained hexahydroxydiphenylene ketone (?), $C_{13}H_8O_7$, and hexahydroxydiphenyl. It is now shown that the former compound gives the *penta-acetyl* derivative, $C_{13}H_3O_7(C_2H_3O)_5$ (small, colourless prisms, m. p. 217—219°), and the *pentabenzoyl* derivative,

$$C_{13}H_3O_7(C_7H_5O)_5$$

(colourless plates, m. p. 257—259°). Its constitution must accordingly be



as surmised by Graebe (*loc. cit.*), and this further confirms the above results.

On oxidation by this method, salicylic acid gives a product insoluble in water, and this result is being investigated together with the behaviour of other acids in this respect.

115. "The reduction of *iso*phthalic acid. Part II." By William Lawton Goodwin and William Henry Perkin, jun.

The authors describe a convenient method for the preparation and separation of the *cis*- and *trans*-modifications of hexahydro*iso*phthalic acid, and show that the acid melting at 120—122° (Perkin, *Trans.*, 1891, **59**, 814; Baeyer and Villiger, *Annalen*, 1893, **276**, 255), which has so far been assumed to be pure *trans*-hexahydro*iso*phthalic acid, is, in reality, a mixture of about equal quantities of the *cis*- and *trans*-modifications. This mixture cannot be resolved by crystallisation, but treatment with calcium chloride and excess of ammonia on the water-bath causes the whole of the *cis*-acid to separate in the form of the sparingly soluble calcium salt, and the pure *trans*-acid is then obtained from the mother-liquors.

cis-Hexahydro*iso*phthalic acid melts at 162—163° and the *trans*-modification at 148°. These acids are partially converted into one another by heating with hydrochloric acid at 170°, and the *trans*-acid is completely converted into the anhydride of the *cis*-acid when it is heated with acetyl chloride at 150°. The action of bromine on these acids has been investigated, and the behaviour of mono- and di-bromo-*trans*-hexahydro*iso*phthalic acids, on treatment with alkalis, is discussed in detail.

116. "Complex ammonium antimonious halides." By Robert Martin Caven.

Numerous double or complex alkali antimonious halides have previously been described (H. L. Wells and F. J. Metzger, *Chem. News*, 1901, **84**, 194). The existing types exhibit the following molecular ratios of alkali to antimonious halide, with or without water of crystallisation: 4 : 1, 3 : 1, 7 : 3, 2 : 1, 3 : 2, 1 : 1, 3 : 4, 4 : 7, 1 : 2, 1 : 3.

The following new salts have now been prepared:

$7NH_4Br,3SbBr_3$, pale yellow, hexagonal plates (found $NH_4 = 7{\cdot}18$; $Sb = 20{\cdot}39$; $Br = 72{\cdot}39$: calculated $NH_4 = 7{\cdot}13$; $Sb = 20{\cdot}42$; $Br = 72{\cdot}45$ per cent.).

$3NH_4Br,2SbBr_3$, bright yellow prisms (found $NH_4 = 5{\cdot}44$; $Sb = 23{\cdot}52$; $Br = 70{\cdot}94$: calculated $NH_4 = 5{\cdot}32$; $Sb = 23{\cdot}72$; $Br = 70{\cdot}97$ per cent.).

$3NH_4I,2SbI_3$, deep red, tetragonal plates (found $NH_4 = 3{\cdot}75$; $Sb = 16{\cdot}70$; $I = 79{\cdot}24$: calculated $NH_4 = 3{\cdot}76$; $Sb = 16{\cdot}74$; $I = 79{\cdot}49$ per cent.).

The double iodide had previously been obtained crystallising with $3H_2O$; the anhydrous compound is sensitive to light, the surface of a small quantity kept in a tube placed in a desiccator over sulphuric acid becoming light brown after some weeks.

The method of preparation of these salts consists in adding excess of glacial acetic acid (99—100 per cent.) to a concentrated aqueous solution of the two halides and the halogen acid, the complex salt quickly separating in a well crystallised condition. The same complex iodide always resulted, although the two constituent salts were mixed in varied proportions.

In the case of the bromides, the bright yellow salt was only obtained free from admixture with the pale salt when an amount of antimonious bromide in excess of that indicated by the formula was employed.

These salts, unlike ammonium platinichloride, are easily soluble in absolute alcohol, and, in the case at least of the bromides, the colours of their solutions in this solvent, as well as in the corresponding halogen acid, show that they do not break up considerably into their constituents when dissolved. Ammonium halide slowly separates from cold alcoholic solution, and evaporation gives rise to a mixture. An alcoholic solution of the pale bromide becomes darker when heated, but returns to its original colour on cooling; the bright yellow salt also forms a pale solution which darkens on heating. Thus it appears that two complex salts can exist in solution, a transition from one to the other taking place with change of temperature.

117. "The replacement of hydroxyl by bromine."

By William Henry Perkin, jun., and John Lionel Simonsen.

The preparation of compounds containing several atoms of bromine, by the action of hydrobromic acid on the corresponding alcohols, gives frequently very unsatisfactory results, not only because the reaction is usually incomplete, but also because considerable decomposition and formation of carbonaceous matter nearly always takes place. The authors find that much more satisfactory results are obtained when the acetate of the alcohol is heated at about 150°, with a solution of hydrogen bromide in acetic acid (saturated at 0°).

The following cases have been studied:

Triacetin yields *s*-tribromopropane, $CH_2Br{\cdot}CHBr{\cdot}CH_2Br$.

Erythritol tetracetate yields *s*-tetrabromobutane,

$$CH_2Br{\cdot}CHBr{\cdot}CHBr{\cdot}CH_2Br.$$

Penterythritol tetracetate, $C(CH_2{\cdot}O{\cdot}C_2H_3O)_4$, yields *s*-tetrabromotetramethylmethane, $C(CH_2Br)_4$, and tribromotrimethylcarbinyl acetate, $(CH_2Br)_3C{\cdot}CH_2{\cdot}O{\cdot}C_2H_3O$.

Mannitol hexacetate is converted into pentabromohexyl acetate, $C_6H_8Br_5(O{\cdot}C_2H_3O)$, and in this case it was not found possible to remove the remaining acetyl group even when the substance was heated at 170° for several hours with the acetic acid solution of hydrogen bromide.

118. "The ethereal salts and amide of dimethoxypropionic acid derived from *d*-glyceric acid." By Percy Faraday Frankland and Norman Leslie Gebhard.

The authors describe the preparation and properties of methyl, ethyl, propyl, butyl, heptyl, and octyl dimethoxypropionates, which they have obtained by the direct methylation by Purdie's method (*Trans.*, 1899, **75**, 153 and 483) (methyl iodide and silver oxide) of the corresponding ethereal salts of *d*-glyceric acid.

The *d*-glyceric esters are all lævorotatory, as are also the corresponding dimethoxypropionates, the latter having, however, a much higher molecular rotation, whilst the molecular rotations of the diacetylglycerates, di-propionylglycerates, di-monochloracetylglycerates, di-dichloracetylglycerates, di-trichloracetylglycerates, and di-phenacetylglycerates are intermediate between the two.

As in the case of the glycerates, the molecular rotation in the normal series attains a maximum in either the amyl, hexyl, or heptyl term (the normal amyl and hexyl terms being still unknown, the highest molecular rotation actually observed is that of the heptyl ester).

Tables are given comparing the molecular rotations of lactic and glyceric derivatives, on the one hand, and of malic and tartaric derivatives on the other.

The amide and methylamide of dimethoxypropionic acid have also been prepared. The amide has a higher molecular rotation (lævo) than glyceramide, whilst that of the methylamide is higher still.

The esters of dimethoxypropionic acid have their rotation diminished by rise of temperature, whilst the latter increases the rotation of the glycerates and diacetylglycerates.

119. "The influence of phosphates on the fermentation of glucose by yeast juice. Preliminary communication." By Arthur Harden and William John Young.

It has previously been shown by the authors (*J. Physiol.*, 1904, **32**; *Proceedings*, Nov. 12th) that the amount of glucose fermented by a

given volume of yeast juice is greatly increased by the addition of boiled and filtered yeast juice.

When the rates of evolution of carbon dioxide are compared from (1) a mixture of yeast juice and glucose, and (2) a similar mixture to which boiled and filtered yeast juice has been added, it is found that two phenomena are concerned in the production of this increased fermentation in the presence of boiled yeast juice:

(*a*) The addition of the boiled juice produces an initial rapid evolution of carbon dioxide, which soon diminishes until a rate is attained which remains constant for many hours.

(*b*) This steady rate is usually, but not invariably, approximately equal to that given by an equal volume of the same yeast juice and sugar to which no addition has been made, but diminishes more slowly than this, so that the fermentation continues for a longer period.

The greater proportion of the total increase is usually due to this second phenomenon.

A similar initial rapid evolution of carbon dioxide occurs when a solution of sodium or potassium orthophosphate is added instead of the boiled juice, but in this case no marked prolongation of the fermentation is observed.

The extra quantity of carbon dioxide evolved in this initial period may be calculated by subtracting the amount corresponding with the constant rate from the total amount observed. It is then found that this quantity corresponds with the evolution of one molecular proportion of carbon dioxide for every atom of phosphorus added in the form of sodium or potassium orthophosphate, or present in the boiled juice in a form precipitable by magnesia mixture. The greatest amount of carbon dioxide hitherto obtained in this way from 25 c.c. of yeast juice is 0·46 gram, corresponding with the addition of about 1·5 grams of anhydrous disodium hydrogen phosphate.

Ordinary yeast juice itself contains a certain amount of dissolved phosphate, and hence, when sugar is added to it, the same phenomenon of an initial rapid evolution of carbon dioxide is observed, but it is usually small in amount.

This evolution of carbon dioxide is accompanied in all cases by the production of an equimolecular proportion of alcohol, and represents the alcoholic fermentation of a corresponding amount of glucose.

When the liquid in which fermentation has been carried on in presence of phosphate is boiled and filtered, the added phosphorus is found in the filtrate, but it is no longer in a form precipitable by magnesia mixture or silver nitrate. The exact mode of combination of this phosphorus in the filtrate and in the unboiled liquid has not yet been definitely ascertained.

Many other questions of interest arise in connection with this phenomenon and the whole subject is still under investigation.

120. "A contribution to the study of alkylated glucosides." By James Colquhoun Irvine and Adam Cameron.

By alkylating β-methylglucoside by means of silver oxide and methyl iodide, tetramethyl β-methylglucoside was produced, which was shown to be identical with the crystalline pentamethylated glucose previously obtained by the methylation of tetramethyl glucose. This confirms the idea that the alkylation of this sugar results in the formation of two isomeric alkylated glucosides which correspond respectively to α- and β-methylglucosides. The specific rotations of the completely methylated β-methylglucoside in water, alcohol, acetone, and benzene proved to be −17·34°, 17·43°, 18·07°, and 16·56° respectively.

The interconversion of α- and β-tetramethylmethylglucosides was carried out by heating either form with solutions of hydrogen chloride (0·25 per cent.) in methyl alcohol, acetone, ether, or benzene, the change being more rapid in alcohol than in the other solvents. In the absence of hydrogen chloride, no transformation took place.

Tetramethyl β-methylgalactoside was also prepared by alkylating β-methylgalactoside, and proved to be identical with the crystalline pentamethylated galactose already described (*Trans.*, 1904, **85**, 1071), and thus the nature of the latter compound is established. In the course of this work a fully methylated galactoside was obtained which differed from the well-defined α- and β-isomerides in displaying a very low dextrorotation and in showing comparatively small changes in rotatory power when hydrolysed.

ADDITIONS TO THE LIBRARY.

III. *Pamphlets.*

Fresenius, H. Chemische Untersuchung der Römerquelle in Bad Ems. pp. 23. Wiesbaden 1905.

Long, J. H. Some complete urine analyses. (From the *J. Amer. Med. Assoc.*, 1905.)

—— On the specific rotation of salts of casein. (From the *J. Amer. Chem. Soc.*, **27**, 1905.)

Warington, Robert. Lost fertility: the production and loss of

nitrates in the soil. (From the *Trans. Highland and Agric. Soc. of Scotland*, 1905.)

Wetherell, E. W. A solution of the problem of the relationship of the elements, and a theory of the nature of matter deduced from the laws which govern the values of the atomic weights. pp. 40. angalore [1904].

LIST OF FELLOWS, 1905.

The List of Fellows for 1905 is now in active preparation, and no change of address received after July 31st, 1905, can be included in it.

At the next Meeting, on **Wednesday**, June **14th**, 1905, at **5.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Influence of various sodium salts on the solubility of sparingly soluble acids." By J. C. Philip.

"The dielectric constants of phenols and their ethers dissolved in benzene and *m*-xylene." By J. C. Philip and Miss D. Haynes.

"Synthesis by means of the silent electric discharge." By J. N. Collie.

"The ultra-violet absorption spectra of benzene and certain of the mono-substituted derivatives." By E. C. C. Baly and J. N. Collie.

"Association in mixed solvents." By G. Barger.

"The ultra-violet absorption spectra of derivatives of benzene. Part II. The phenols." By E. C. C. Baly and Miss E. K. Ewbank.

"The action of water on diazo-salts. A preliminary note." By J. C. Cain and G. M. Norman.

"Synthesis of substances allied to epinephrine." By G. Barger and H. A. D. Jowett.

"A precise method of determining the organic nitrogen in potable waters." By J. Campbell Brown.

"Synthesis of 1 : 1-dimethyl-Δ^3-tetrahydrobenzene." By A. W. Crossley and Miss N. Renouf.

"Bromine in solutions of potassium bromide." By F. P. Worley.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Wednesday, June 14th, 1905.

Bealey, Edward Williams,

55, Belsize Park Gardens, Hampstead, London, N.W.

Gentleman. B.A. (Honours), Cambridge. Chemical Student, Finsbury Technical College. Interested in Chemical Discoveries and Investigations.

R. Meldola. F. Southerden.
John Castell-Evans. Harley F. Knight.
Chas. R. Darling.

Bees, William James,

43, Ash Grove, Hyde Park, Leeds.

Inspector of Schools to the Leeds Education Committee. B.Sc. (Lond.). Would be glad of the opportunity thus afforded to keep in touch with the most recent literature on the subject.

Arthur Smithells. S. Parrish.
W. Lowson. W. Ludford Freeman.
J. Hembrough.

Bennett, Joseph,

North Adams, Mass., U.S.A.

Print Works Manager. Silver Medallist of City and Guilds of London Institute. 1st Class Honors in Chemistry, South Kensington Examinations. Manager of the Windsor Printing Co., North Adams, Mass., U.S.A. Am desirous of getting the Publication of the Society for a knowledge of the latest work in chemistry.

Fred. S. Watson. Fred. R. Grundey.
S. Bradbury. Samuel Pollitt.
Fredk. Davis. *W. H. Perkin, jun.*

Bousfield, William Robert,

St. Swithin's, Hendon.

Barrister-at-Law, K.C. M.A. Cantab. Author of the following papers: "Influence of Temperature on the Conductivity of Electrolytic Solutions" (*Proc. Roy. Soc.*, 1902, **71**, pp. 42—54), "The Purification of Water by Continuous Fractional Distillation" (*Proc. Chem. Soc.*, 1903, **20**, 49), "The Electrical Conductivity and Other Properties of Sodium Hydroxide in Aqueous Solutions" (*Phil. Trans.*, 1905, **204**, 253—322), "Ionic Sizes in Relation to the Conductivity of Electrolytes" (*Proc. Roy. Soc.*, **74**, 563—564, 1905).

William A. Tilden. M. O. Forster.
Thomas Martin Lowry. R. Meldola.
W. H. Perkin, jun.

Campbell, Eric William,

97, Eaton Square.

Student at Central Technical College, South Kensington. Educated at Eton. Studied Chemistry for two years at Neuenheim College, Heidelberg. Now a student in the Department of Chemistry at Central Technical College, South Kensington.

Gerald T. Moody. William A. Davis.
E. Frankland Armstrong. W. A. Lethbridge.
E. Horton. R. Berncastle.
M. O. Forster.

Cowie, William Beaverly,

26, East Claremont St., Edinburgh.

Teacher of Chemistry, Edinburgh Central School of Pharmacy. Student of Chemistry under Prof. W. H. Perkin, Ph.D., F.R.S., &c., 1889, 1890, 1891. Engaged in Analytical and Manufacturing Chemistry at the Laboratories of Messrs. T. and H. Smith & Co., Edinburgh, from 1892 to 1895. Teacher of Chemistry, Edinburgh Central School of Pharmacy, from 1895 to 1905.

W. H. Perkin, jun. Leonard Dobbin.
J. Gibson. George Senter.
H. Burrows.

Day, William Walpole,

Ellerslie, Harrogate.

Science Master. Bachelor of Science (Organic and Inorganic Chemistry and Mathematics), University of Wales. Science Master since 1898. Four years' work at Shaftesbury Grammar School and 2½ years' work at King Edward VI. School, Nuneaton, including in

each case reorganisation of the Science side and building and fitting up of new laboratories.

J. J. Sudborough. J. P. Millington.
T. Campbell James. H. O. Jones.

W. J. Sell.

De Lury, Ralph Emerson,
Manilla, Ontario, Canada.

Fellow in Chemistry, University of Toronto. B.A., 1st Class Honours in Physics and Chemistry, University of Toronto, 1903; M.A., University of Toronto, 1904; has been instructor in the Department of Chemistry since graduation. Publications: "Rate of Oxidation of Potassium Iodide by Chromic Acid," *Journal of Physical Chemistry*, Vol. 7, No. 4, April, 1903.

W. R. Lang. W. H. Ellis.
W. Lash Miller. *William Ramsay.*

W. Lester Alton.

Donald, Robert,
75, Clyde St., Dunedin, N.Z.

B.A., M.A., B.Sc. (N.Z.); M.R.C.S. (Eng.); L.R.C.P. (Lond.); D.P.H. (Oxon.); holder of "A4" certificate as teacher under the Education Department of N.Z. Now practising Medicine. Studied Chemical Technology, and worked out a thesis on "The Composition and Calorific Power of some N.Z. Coals"; thus gained the M.A. degree with Honours (2nd class—Home examiners). Acted for two months in each of two successive years as Science Teacher in the Otago Training College, and for six months as (relieving) Science Master in Otago High School. As I am returning to New Zealand I wish to obtain the Journal of the Chemical Society, and to keep in touch with current Chemical Science.

Frederic Jas. M. Page. Hermann C. T. Gardner.
Hugh C. H. Candy. *John Wade.*

John Greenaway.

Forster, Ernest Lyle Carman,
Brampton, Ontario, Canada.

Assistant in Chemistry, University of Toronto. B.A., 1903, Chem. and Min. (Honours II. Class); M.A., 1904, Toronto: has been instructor in the Department of Chemistry since graduation; Publication:—"The Rate of Formation of Iodates in Alkaline Solutions of Iodine," *Dec.*, 1903, Journal of Physical Chemistry.

W. R. Lang. W. H. Ellis.
W. Lash Miller. *William Ramsay.*

W. Lester Alton.

Henstock, Herbert,

Feldeggstrasse 33, Zürich V, Switzerland.

Student of Chemistry. (1) Paper on Brom-dimethyl- and -trimethyl-succinic acids by W. A. Bone and H. Henstock (Trans. Chem. Soc., 1903, vol. 83). (2) I was three years as chemist to Messrs. Harrison, Blair & Co., Alkali Works, Farnworth, nr. Bolton, Lancs. (3) I took my degree, B.Sc. (Honours in Chemistry), Victoria University, 1902. (4) I have studied for 2 years at the University of Zürich under Prof. Werner, preparatory to taking the Ph.D. degree.

H. B. Dixon. G. H. Bailey.
W. H. Perkin, jun. D. L. Chapman.
Norman Smith. William A. Bone.

Jarrard, William John,

41, Whittingstall Road, Fulham, S.W.

Demonstrator in Chemistry. B.Sc. (London, First Class Honours in Chemistry). A.R.C.Sc. (London). Teaching Associate, Royal College of Science (London). Student, Mason-University College, Birmingham (1896—1899), and Royal College of Science (London), 1899—1901 and 1902—1903. Science Master, the Grammar School, Amersham (1901—1902). Student-Demonstrator in Chemistry at Royal College of Science (1903—1905). Lecturer and Demonstrator in Chemistry at the Polytechnic, Kingston-on-Thames.

William A. Tilden. G. T. Morgan.
M. O. Forster. Chapman Jones.
G. S. Newth.

Mason, Arthur Walter,

6, Northumberland Place, North Shields.

Science Master. Bachelor of Science, London University (First Class in Final, Inter., and Matric.). Science Master, Tynemouth Secondary School and Pupil Teachers' Centre. Lecturer and Demonstrator in Chemistry in Evening Classes under Borough Council. Lecturer in Science to Teachers' Training Classes under Borough Council.

George Frederick Tyler Phillips. D. Tyrrell.
S. Hewitt. *Thomas L. D. Porter.*
Francis Sutton.

Ross, Frederick Wilson Montrose,

21, Soho Square, W.

Analyst to Messrs. Crosse and Blackwell, Ltd. Student at Finsbury Technical College, Evening Session, 1901—1902. 2½ years in the

laboratory of Messrs. Burroughs, Wellcome & Co. Four years analyst to Messrs. Crosse and Blackwell.

R. Meldola. F. Henry Streatfeild.
Wyndham R. Dunstan. J. C. Crocker.
John Castell-Evans. F. H. Lowe.

Steger, James,
111, Chesterfield Road, Bristol.

Science Teacher. B.Sc. (London) in Chemistry. Teacher of Chemistry for over ten years. Have worked as student in the laboratories of University College, Bristol, Yorkshire College, Leeds, and Royal College of Science.

Ernest H. Cook. Chapman Jones.
M. O. Forster. James C. Philip.
G. T. Morgan. *William A. Tilden.*

Tuck, William Bradshaw,
University College, Gower Street, W.C.

Student. Inter. B.Sc. Have been 3 years in Sir William Ramsay's laboratory. At present engaged in Research Work.

William Ramsay. Edward C. Cyril Baly.
J. Norman Collie. J. K. H. Inglis.
Samuel Smiles.

White, John William,
9, Hampden Place, Halifax, Yorks, and University College, London.

Student. Intermediate, B.Sc. Two years in Sir William Ramsay's Laboratory, University College.

William Ramsay. J. K. H. Inglis.
J. Norman Collie. Edward C. Cyril Baly.
Samuel Smiles.

Wren, William James,
271, Park Road, Oldham.

Science Master, Waterford High Schools. Associate (Faculty of Applied Chemistry), ex-Royal Scholar and Exhibitioner, Royal College of Science, Dublin. Formerly private assistant to Professor W. N. Hartley and Demonstrator under the Department of Technical Instruction.

W. N. Hartley. F. G. Donnan.
J. Holms Pollok. *W. E. Adeney.*
J. Campbell Brown.

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Issued 30/6/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 298.

Wednesday, June 14th, 1905, Professor R. MELDOLA, F.R.S., President, in the Chair.

Mr. G. W. T. Horrod was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs. :

Harry Dunlop, Cragdarroch Cove, Dumbartonshire.

Eric Haydn-Morris, c/o Messrs. G. Mowling & Son, Footscray, Melbourne, Victoria.

The PRESIDENT announced that it had been decided by the Council that the ordinary meetings of the Society shall be held during the ensuing Session on the first and third Thursdays at 8.30 p.m.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

Edward Williams Bealey, B.A.
William James Bees, B.Sc.
Joseph Bennett.
William Robert Bousfield, M.A., K.C., M.P.
Eric William Campbell.
William Beaverly Cowie.
William Walpole Day, B.Sc.
Ralph Emerson De Lury, M.A.
Robert Donald, M.A., B.Sc., M.R.C.S., L.R.C.P.
Ernest Lyle Carman Forster, M.A.
Herbert Henstock, B.Sc.
William John Jarrard, B.Sc.
Arthur Walter Mason, B.Sc.
Frederick Wilson Montrose Ross.
James Steger, B.Sc.
William Bradshaw Tuck.
John William White.
William James Wren.

Of the following papers, those marked * were read :

***121. "Influence of various sodium salts on the solubility of sparingly soluble acids." By James Charles Philip.**

That magnesium hydroxide is more soluble in ammonium chloride solutions than in pure water is due, according to one current explanation, to the formation of undissociated ammonium hydroxide and the consequent removal of hydroxyl ions, this leading to the solution of more hydroxide. If this is so, then conversely the solubility of sparingly soluble acids should be increased in the presence of sodium salts of weak acids. This is found to be actually the case, and the influence of sodium formate, acetate, and butyrate on the solubility of cinnamic, benzoic, salicylic, and *o*-nitrobenzoic acids has been determined at 26·4°. It is to be expected on theoretical grounds, and the expectation is confirmed by the experimental results, that the extent to which the solubility of a given sparingly soluble acid is increased by the presence of the sodium salt NaA will depend on the strength of the acid HA. If the concentration of the sparingly soluble acid in the saturated solution is plotted against the concentration of the added salt (NaA, NaA′, NaA″, &c), it is found that the order of the curves so obtained is the order of strength of the acids HA, HA′, HA″, &c. Further, the increase of solubility of cinnamic acid (for example) in a solution of NaA of known concentration, as compared with its solubility in pure water, can be calculated in good agreement with experiment when the solubility product for cinnamic acid and the dissociation constant of the acid HA are known.

***122. "The dielectric constants of phenols and their ethers dissolved in benzene and *m*-xylene." By James Charles Philip and Dorothy Haynes.**

Evidence was brought forward some time ago by one of the authors (Philip, *Zeit. physikal. Chem.*, 1897, **24**, 18) showing that the dielectric constant of an alcohol calculated from the dielectric constant of its benzene solution decreases as the concentration of the alcohol decreases, and is in all cases less than the directly determined dielectric constant of the pure alcohol. This behaviour, connected probably with the associative tendency of the alcohol molecules, has now been observed also in the case of phenols. The phenomenon is well marked in the case of phenol itself, but less distinct in the case of the cresols; indeed, the dielectric power of *o*-cresol in benzene solution seems to be nearly independent of the concentration. The phenol ethers, in which the associative tendency has been got rid of by obliterating

the hydroxy-group, exhibit an almost normal dielectric behaviour in benzene solution. It is noteworthy that the introduction of a methyl group at any point in the ring lowers the dielectric constant of anisole, the lowering effect, however, of the methyl group being much greater in the ortho-position than in either the meta- or para-position.

Discussion.

Sir William Ramsay inquired whether Dr. Philip's measurements threw any light on the fact that the molecular weight of alcohol in benzene solutions may rise as high as 230. Was this due to polymerisation of the alcohol or to a compound of alcohol with benzene?

Dr. Philip said that although the dielectric property of alcohol in benzene had been found to diminish with dilution in an analogous manner to the molecular weight, no evidence had been obtained bearing on the point referred to by Sir William Ramsay.

***123. "Synthesis by means of the silent electric discharge." By John Norman Collie.**

When pure ethylene was submitted to the action of the silent electric discharge in a vessel cooled to $-20°$, polymerisation occurred, and a liquid was produced together with some hydrogen gas. In one experiment, 210 c.c. of ethylene gave about 40 c.c. of hydrogen.

Ten grams of the liquid produced by the polymerisation of ethylene were fractionated. The fractions collected and their analyses were as follows:

	100°.	100—150°.	150—200°.	200—250°.	Residue.	Distilled residue.
C	83·4	85·3	85·8	86·0	87·7	87·7
H.....	16·0	15·3	14·3	14·0	12·4	12·3

The first fraction was very small; most of the distillate collected in the two fractions 100—150° and 150—200°, the chief part boiling between 130° and 170°. The residue left in the flask was a dark resinous substance, which, on heating, smelt of burnt india-rubber; this product weighed 4 grams, or two-fifths of the whole.

The decrease in hydrogen and increase in carbon in the above analyses is interesting; olefinic hydrocarbons, C_4H_{24} require C = 85·7; H = 14·3; $C_{20}H_{34}$ requires C = 87·7; H = 12·3 per cent.

These various fractions were oxidised by means of potassium permanganate solution in the cold. After filtering off the precipitated manganese oxide, the solution of potassium salts was acidified; a strong odour of either valeric or caproic aldehyde was at once produced in the case of the two fractions (100—150°) and (150—200°). These aldehydes were distilled in steam and oxidised with silver

oxide. The silver salt gave, on analysis, Ag = 48 per cent., which is equivalent to an acid of molecular weight 118, that of caproic acid being 116.

Ethylene was also mixed with carbon monoxide and submitted to the silent electric discharge, when aldehydes were formed in small quantity. Formaldehyde and acrolein were both probably present, but the chief condensation that occurred was that of the ethylene itself to form hydrocarbons having high boiling points.

The facts that are of especial interest are that ethylene under the influence of the silent electric discharge at the ordinary temperature will not only unite with carbon monoxide, but will also polymerise, yielding a series of complicated hydrocarbons; the chief substances formed boil at about 150—160° and apparently approximate in composition to $C_{10}H_{20}$; moreover, further condensation means loss of hydrogen and the formation of compounds approximating both in properties and composition to the terpene derivatives. On oxidation, the olefinic hydrocarbons break down, yielding compounds containing about six carbon atoms in the molecule.

Discussion.

Mr. Harcourt referred to experiments on ozone by Sir B. Brodie, in which the oxygen exposed in a Siemens tube to the silent discharge was mixed with a large proportion of carbon dioxide, the idea being that ozone might be protected during its formation by dilution with carbon dioxide and obtained afterwards in a concentrated form by absorption of the diluent. The results, however, showed that carbon dioxide was decomposed and ozone formed from it; moreover, a brown coating was deposited on the glass, this product being readily soluble in water. This experiment seemed to be an illustration of Dr. Collie's view that the syntheses which plants effect under the influence of sunlight, forming complex products out of carbon dioxide and water, may be to some extent paralleled by the action of the silent discharge.

Professor Tilden reminded the author that experiments of the same character and having similar results had already been carried out by Berthelot (Journ. Chem. Soc., 1876, ii, 596).

The President considered that not the least interesting part of Professor Collie's paper was the fact that he had succeeded in obtaining a sufficient quantity of the synthesised products to enable him to give definite and quantitative information as to their nature. Most of the workers who had studied the synthetical action of the silent electric discharge had hitherto only given qualitative results. With reference to the polymerising action of this discharge, he (the President) mentioned that some years ago, in conjunction with Mr. R. J. Strutt, he had

made some experiments having for their object the possible combination of argon with acetylene. No combination was observed, but the polymerising action of the discharge on the acetylene was very obvious, an accumulation of tarry and resinous products being obtained, but these were not further examined, as practically the whole of the argon originally mixed with the acetylene was recovered at the end of the experiments. With respect to photosynthetic processes, he thought it might be of interest, in view of the modern developments of radioactivity, to call attention once again to the older work of Fay and of Seekamp, who state that photochemical decompositions are in many cases promoted by the addition of uranium salts to the solutions. This raises the question whether the energy, which must be supposed to be liberated on the "disintegration" hypothesis of the uranium atom, may not play a part in such photochemical processes.

***124. "The ultra-violet absorption spectra of aromatic compounds. Part I. Benzene and certain mono-substituted derivatives." By Edward Charles Cyril Baly and John Norman Collie.**

The ultra-violet absorption spectra of benzene and of some of its mono-substituted derivatives were described. It has been found that benzene presents seven separate absorption bands, and it was shown how the formation of these may be accounted for by attributing each one to a separate and distinct process of dynamic isomerism connected with the linking changes within the benzene molecule. In the case of the mono-substituted derivatives of benzene, it is shown how their absorption spectra may be arranged in types, and it appears that each type corresponds either to complete saturation or to the nature and position of unsaturated atoms in the substituent group. The presence of an unsaturated atom in the α-, β-, or γ-position in the side-chain thus produces a particular type of absorption. When the unsaturated atom is present in the δ-position, it is apparently removed too far from the nucleus to exercise any effect, with the result that the same absorption spectrum is obtained as if the side-chain were completely saturated.

***125. "The ultra-violet absorption spectra of aromatic compounds. Part II. The phenols." By Edward Charles Cyril Baly and Elinor Katharine Ewbank.**

The ultra-violet absorption spectra of anisole and phenetole are found to differ from that of phenol; in the former cases, the single absorption band given by phenol is subdivided near its head into two bands.

The absorption band produced by the dynamic isomerism existing in solutions of acetylacetone and similar tautomeric substances of the aliphatic series occupies very nearly the same position as the band given by phenol. The existence of a similar type of dynamic isomerism in the case of phenol would, therefore, explain the difference between the spectra of phenol and its ethers. The presence of this kind of tautomerism, that is, a labile hydrogen atom, in phenol is proved by the influence of acid and alkali on the spectrum of this substance. Just as in the case of certain aliphatic tautomeric compounds, the position of the absorption band is shifted towards the red on the addition of sodium hydroxide, whilst the addition of acid tends to restrain the dynamic isomerism. The results obtained with the three dihydroxybenzenes, the three cresols, and *p*-aminophenol support the view that similar tautomerism exists in these substances.

***126. "Association in mixed solvents." By George Barger.**

The association which many hydroxylated substances exhibit in some solvents (benzene, chloroform) does not occur in others (alcohol, acetic acid), probably because the latter form loose molecular compounds with the solute according to the law of mass action (Abegg, *Zeit. anorg. Chem.*, 1904, **39**, 330). In dilute solutions, the concentration of the solvent is large compared with that of the solute, and if the solvent is dissociative its influence predominates. The present investigation deals with cases in which the concentration of the dissociative solvent was reduced by mixing it with an associative one.

The dissolved substances were acids, alcohols, phenols, and oximes. Dilute solutions of these were made in mixtures of toluene, benzene, chloroform, or carbon tetrachloride with one of the following dissociative solvents: pyridine, acetic acid, ethyl acetate, methyl acetate, ethyl formate, ethyl alcohol, methyl alcohol, and acetone. The molecular weight of the solute was determined by the author's microscopic method (*Trans.*, 1904, **86**, 286), this process being particularly suited for work with mixtures.

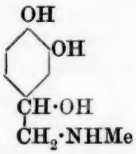
The results are in general agreement with what might be expected from mass action according to the above theory. The molecular weight is normal in nearly all the mixtures, and association only persists when the percentage of the dissociative solvent is very small.

The esters are the least powerful of the dissociative solvents examined, which is in accordance with their behaviour in other respects. For instance, as the result of a study of the boiling points of homologous series, Young places the esters between associated and non-associated liquids (*Phil. Mag.*, 1905, [vi], **9**, 1).

According to Lachman (*J. Amer. Chem. Soc.*, 1903, **25**, 50), brown solutions of iodine owe their colour to the formation of loose molecular compounds between solute and solvent. If equal volumes of an alcoholic and a chloroform solution containing equal quantities of iodine are mixed, the colour of the mixture is not intermediate between that of the component solutions, but is more like that of the alcoholic solution. This experiment serves to illustrate the mass action effect of the solvent.

***127. "Synthesis of substances allied to epinephrine." By George Barger and Hooper Albert Dickinson Jowett.**

The authors have attempted to synthesise a compound having the formula



which was proposed by one of them (Trans., 1904, **85**, 192) for epinephrine (adrenaline), the active principle of the suprarenal gland.

Although the methylene and dimethyl ethers were prepared, the dihydroxy-base could not be isolated.

The constitution of the ether bases was proved by their oxidation to piperonylic or veratric acid respectively. The dihydroxy-base could not be obtained from the ethers, although indications of the formation of a substance having the chemical and physiological properties of epinephrine were obtained by the action of dilute hydrochloric acid at 150° on the methylene ether.

The following compounds were prepared and described: α-3 : 4-*methylenedioxyphenyl-αβ-dibromoethane*, $CH_2{:}O_2{:}C_6H_3{\cdot}CHBr{\cdot}CH_2Br$, needles, m. p. 82—83°; α-3 : 4-*methylenedioxyphenyl-β-bromo-α-hydroxyethane*, $CH_2{:}O_2{:}C_6H_3{\cdot}CH(OH){\cdot}CH_2Br$, long needles, m. p. 107—108°; β-3 : 4-*methylenedioxyphenyl-β-hydroxyethylmethylamine picrate*,

$$CH_2{:}O_2{:}C_6H_3{\cdot}CH(OH){\cdot}CH_2{\cdot}NHMe,C_6H_3O_7N_3,$$

yellow needles, m. p. 178°; the corresponding *base* and *platinichloride* are amorphous: 3 : 4-*dimethoxystyrene*, $(CH_3O)_2{:}C_6H_3{\cdot}CH{:}CH_2$, colourless liquid boiling at 120—125°/10 mm.; α-3 : 4-*dimethoxyphenyl-αβ-dibromoethane*, $(CH_3O)_2{:}C_6H_3{\cdot}CHBr{\cdot}CH_2Br$, needles, m. p. 102°; α-3 : 4-*dimethoxyphenyl-β-bromo-α-hydroxyethane*,

$$(CH_3O)_2{:}C_6H_3{\cdot}CH(OH){\cdot}CH_2Br,$$

long needles, m. p. 68°.

The corresponding methylamine *base* could not be crystallised, nor could any crystalline salt be obtained.

The piperonyldibromide (m. p. 160°) described by Mameli (*Gazzetta*, 1904, **34**, [i], 358) is really the *dibromohydrin*,

$$CH_2{:}O_2{:}C_6H_2Br{\cdot}CH(OH){\cdot}CH_2Br,$$

and has been obtained by the action of bromine water on the bromohydrin and also by the action of phosphorus pentachloride on the dibromide.

***128 "The determination of melting points at low temperatures." By Leo Frank Guttmann.**

A method has been worked out for readily determining melting points at low temperatures by means of a constantan-copper couple connected to a delicate galvanometer. The couple was calibrated by immersion in substances of known melting point; ice, chloroform, ether, liquid air, and a mixture of solid carbon dioxide and alcohol being chosen. The melting point of ethyl bromide had been determined by a previous observer to be $-129{\cdot}5°$, and it is now shown to be $-118°$, the low number formerly obtained being due to an admixture of ether. The melting point of some very pure toluene was also found to be higher than that of ordinary pure toluene, to which the melting point $-97°$ to $-99°$ had been ascribed.

The melting points determined were methyl alcohol, $-98°$; ethyl alcohol, $-117{\cdot}3°$; methyl iodide, $-64°$; ethyl chloride, $-142°$; ethyl bromide, $-118°$; ethyl iodide, $-109°$; toluene, $-92°$; *m*-xylene, $-55°$; ethylbenzene, $-93°$.

Ethyl alcohol was found to have the property of supercooling to a remarkable degree. It could be frozen to a clear, transparent glass by immersion in liquid air, and if it was then allowed to warm up slowly to $-135°$, crystallisation set in explosively, the temperature rising about 20° in 10 seconds and a white, opaque mass of crystallised alcohol being formed.

29. "The action of water on diazo-salts. A preliminary note." By John Cannell Cain and George Marshall Norman.

One of the authors has shown (*Trans.*, 1903, **83**, 688) that little or no hydroxy-compound is obtained by boiling certain ortho-substituted diazo-salts of the diphenyl series with dilute acids, but that quinonoid derivatives resulted. As there are a large number of similarly substituted compounds belonging to the benzene series which are said not

to yield the corresponding phenols on boiling with water or acids, it appeared to be of interest to examine these with the object, if possible, of elucidating the course of the reaction.

s-Tribromoaniline.—Silberstein (*J. pr. Chem.*, 1883, **27**, 98) was unable to obtain any phenolic derivative by boiling *s*-tribromobenzenediazonium sulphate or nitrate with dilute acids, and Orton, in a recent communication (Proc., 1905, **21**, 168), obtained no trace of the phenol either with dilute or strong sulphuric acid. By using the method described in the German Patent 95339, which consists in heating the diazo-solution with a mixture of dilute sulphuric acid and sodium sulphate (applied in the patent to the production of guaiacol from *o*-anisidine), we have been able to isolate the corresponding *s-tribromophenol* (m. p. 92—93°), although the yield is small.

The failure of other observers to obtain this product is no doubt explained by the facts that the decomposition point of this very stable diazo-salt is considerably above 100°, and by using more concentrated sulphuric acid in order to reach a higher temperature a very considerable retarding influence is introduced.

This retarding influence can be measured by determining the "coefficient of decomposition, C," according to the method described by one of the authors (*Trans.*, 1902, **81**, 1412). Thus in the case of diazobenzene chloride, the value of C in the case of the chloride is 0·0298 (*loc. cit.*, p. 1420).

A blank experiment in which an equivalent quantity of sulphuric acid was substituted gave exactly the same number, the diazo-solution containing 0·7 per cent. of H_2SO_4. When, however, the amount of sulphuric acid is increased until the solution contains about 35 per cent. of the acid, the value of C becomes 0·0191. It follows, therefore, that an increase in the quantity of sulphuric acid produces an increase in the stability of the diazo-compound (compare *Ber.*, 1890, **23**, 2994).

s-Trichloroaniline.—Hantzsch (*Ber.*, 1895, **28**, 685) prepared a solution of the diazo-chloride of this substance, and was unable to detect the formation of the corresponding phenol by the action of heat. He says, "Trichlordiazobenzolchlorid lässt sich mit Wasser, ja selbst mit Salpetersalzsäure kochen, ohne Stickstoff zu entwickeln oder sich überhaupt zu verändern."

The authors have found that under the usual conditions of boiling a brown substance is formed, but only by adopting the same method as in the foregoing instances can a small yield of *s-trichlorophenol* (m. p. 68°) be obtained.

o-Anisidine.—Several workers have been unsuccessful in obtaining guaiacol from the diazo-compound of *o*-anisidine. Thus Limpach

(*Ber.*, 1891, **24**, 4136) passed a current of steam through the solution, but could detect no guaiacol (compare also Gattermann, *Ber.*, 1899, **32**, 1136).

By passing steam through a strongly acidified solution of the diazo-sulphate for several hours, the authors obtained guaiacol, a still better yield being afforded by the foregoing method. In addition to this product, a small yield of a second substance was isolated; this product crystallised in flat, square tables (m. p. 89°; b. p. 310—312°), giving analytical numbers corresponding with those for the mono-methyl ether of *o*-dihydroxydiphenyl, $OH \cdot C_6H_4 \cdot C_6H_4 \cdot OCH_3$.

3-*Bromo*-p-*toluidine*.—Wroblewski (*Ber.*, 1874, **7**, 1061; *Annalen*, 1873, **168**, 147) describes several halogen derivatives of aniline and toluidine, the diazo-compounds of which do not yield halogenated phenols, but give rise to the corresponding substituted hydrocarbons. In a later paper (*Ber.*, 1884, **17**, 2704), he attributes this abnormality to the presence of a small quantity of alcohol in the diazo-derivative. As regards the above compound, this is probably a correct explanation, as a good yield of the bromo-cresol (b. p. 214°; *Ber.*, 1884, **17**, 2530) is readily obtained by passing steam through an acid solution of the sulphate.

3-*Chloro*-p-*toluidine*, the diazo-compound of which is said by Wroblewski (*loc. cit.*) to yield no corresponding phenol when treated in a similar way, gave rise to 3-*chloro*-p-*cresol* (m. p. 191°).

130. "A precise method of estimating the organic nitrogen in potable waters." By James Campbell Brown.

Details were given of a process for the estimation of the whole of the nitrogen of organic matter in potable water and sewage effluents.

The process is found to be as accurate for this purpose as Kjeldahl's method is for larger quantities of nitrogenous matter, and it has many advantages over Kjeldahl's process in convenience and speed, and in the absence of the liability to breakage and loss by bumping in glass vessels.

The process essentially consists in the distillation to dryness and subsequent ignition of a mixture of a portion, ordinarily 200 c.c., of the sample, without previous evaporation, with potassium hydroxide and potassium permanganate. The operation is carried on either in a Jena glass or in a copper retort, and the ammonia evolved is estimated by Nessler's solution.

The total carbon of the organic matter was also estimated as carbon dioxide in the residue remaining in the retort, but the results were not so accurate as in the case of the nitrogen, owing to the large

amount of carbon dioxide found by blank experiments, which has to be deducted.

The results obtained by this process on a variety of waters are compared with the corresponding values determined by the Frankland, Wanklyn, and Forchammer methods.

131. "Synthesis of 1 : 1-dimethyl-Δ^3-tetrahydrobenzene."

By Arthur William Crossley and Nora Renouf.

When 3-bromo-1 : 1-dimethylhexahydrobenzene (compare Proc., 1905, **20**, 242) is heated with alcoholic potash, it loses the elements of hydrogen bromide with formation of 1 : 1-*dimethyl*-Δ^3-*tetrahydrobenzene*, which is a colourless, refractive liquid boiling at 117—117·5°/770 mm., and having an odour of turpentine. It combines with bromine to form 3 : 4-*dibromo*-1 : 1-*dimethylhexahydrobenzene*, and on oxidation with potassium permanganate yields $\beta\beta$-dimethyladipic acid, a fact which definitely proves its constitution.

A mixture of concentrated nitric and sulphuric acids acts on the hydrocarbon very violently and does not give rise to an appreciable quantity of a nitro-derivative.

The properties of the hydrocarbon are being compared with those of laurolene and *iso*laurolene obtained from derivatives of camphoric acid.

132. "Bromine in solutions of potassium bromide."

By Frederick P. Worley.

The solubility of bromine in aqueous solutions of potassium bromide has been determined over a wide range of concentrations at 18·5° and 26·5°. The curves obtained for concentrations below 0·1 gram-molecule per litre correspond with an additional absorption of two atoms of bromine for every molecule of potassium bromide in solution, probably due to the formation of KBr_3. The curves for higher concentrations of potassium bromide deviate slightly on the side of increased solubility of bromine, probably indicating the formation of small quantities of compounds higher than KBr_3.

The application of the principle of mass action does not lead to any knowledge of the constitution of the polybromide formed in the case of solutions saturated with bromine, but with solutions containing varying amounts of bromine insufficient for saturation the results confirm the formation of KBr_3 with smaller quantities of a higher compound.

The variation of the constants obtained, on the assumption that

KBr_3 alone is formed, may be due to the unequal ionisation of potassium bromide and KBr_3.

A simple process has been devised for the determination of the quantity of a volatile substance present in a system containing various substances in equilibrium, where estimation by chemical means is not possible. It possesses the great advantage over other similar methods of avoiding the presence of a foreign substance such as carbon disulphide.

133. "Tetramethylammonium hydroxide." By James Walker and John Johnston.

A solution of tetramethylammonium hydroxide may easily be prepared by mixing alcoholic solutions of tetramethylammonium chloride and potassium hydroxide. Potassium chloride at once separates and may be removed by filtration. Tetramethylammonium hydroxide may be isolated from this solution as the pentahydrate, $NMe_4 \cdot OH, 5H_2O$, by addition of water and concentration in a vacuum. A trihydrate and a monohydrate are also described. Attempts to prepare the anhydrous hydroxide failed owing to decomposition of the monohydrate into trimethylamine, methyl alcohol, and water.

134. "Tetrethylsuccinic acid." By James Walker and Annie Purcell Walker.

Crum Brown and Walker isolated from the product of electrolysis of sodium ethyl diethylmalonate a crystalline substance having the composition $C_{12}H_{20}O_3$. This substance is now shown to be the anhydride of tetrethylsuccinic acid. It is attacked by alkalis only with great difficulty, but forms sodium methyl tetrethylsuccinate by direct addition with sodium methoxide. This ester salt may be saponified by boiling with aqueous alkalis, and from the salt obtained tetrethylsuccinic acid may be isolated. It is stable in the solid state, but passes in solution or on fusion into water and the anhydride.

135. "The ultra-violet absorption spectra of aromatic compounds. Part III. Disubstituted derivatives of benzene." By Edward Charles Cyril Baly and Elinor Katharine Ewbank.

Hartley (*Trans.*, 1885, 47, 685), in describing the ultra-violet absorption spectra of the three xylenes, showed that the broad absorption band given by the ortho- and meta-compounds was divided into two in the case of the para-compound. *p*-Xylene therefore gives two absorption

bands, while the ortho- and meta-compounds only show one band. In the present paper, the following substances are dealt with, the absorption spectra of the three isomerides being described in each case: the chlorotoluenes, the dichlorobenzenes, the tolunitriles, the chloroanilines, and the toluidines, the last two compounds being examined in acid solution. In every case, the para-compound shows either more absorption bands than the ortho- and meta-isomerides, or the same number of bands with much greater persistence. It may therefore be concluded that the para-compound is always more symmetrical than its two isomerides, that is to say, the motions of the benzene ring, which give rise to the absorption bands, are less disturbed by the para-substitution than by the ortho- and meta-substitutions.

136. "Studies in chlorination. II. The action of chlorine on boiling toluene. Preliminary notice." By Julius Berend Cohen, Harry Medforth Dawson, and Percy Field Crosland.

The object of the authors' experiments was to ascertain if electrolytic chlorine, evolved in presence of boiling toluene, entered the side-chain like ordinary chlorine or caused substitution in the nucleus. The results show that, under the conditions of the experiments, electrolytic chlorine enters the nucleus only, and also that the rate of chlorination appears to be more rapid than that of ordinary chlorine evolved from pyrolusite and hydrochloric acid. The current was conducted through the mixture of toluene and hydrochloric acid by means of carbon electrodes, a special series of determinations being made to find whether the electrodes acted as carriers. No difference could be detected in the character of the products when ordinary chlorine was used, whether carbon electrodes were present or not. When ordinary chlorine was used, between 80 and 90 per cent. of the product was benzyl chloride, the remainder being a mixture of *o*- and *p*-chlorotoluenes. The experiments are being continued.

137. "Purpurogallin." By Arthur George Perkin.

When purpurogallin is methylated by means of methyl sulphate, it yields, in addition to the trimethyl ether previously described (*Trans.*, 1903, **83**, 194), the *tetramethyl* compound, $C_{11}H_4O(OCH_3)_4$ (found, C = 65·18; H = 5·90; CH_3 = 21·57, pale yellow prisms, m. p. 93—94°). *iso*Purpurogallone, for which the formula $C_{11}H_6O_5$ was suggested, is more probably $C_{11}H_8O_5$ (found, C = 60·08; H = 3·54); it gives on digestion with sulphuric acid in the presence of acetic acid the *anhydride*, $C_{11}H_6O_4$ (C = 65·36; H = 2·80, minute, yellow prisms melt-

ing above 310°), the acetyl compound of which is identical with that prepared by the action of acetic anhydride on *iso*purpurogallone (*loc. cit.*). iso*Purogallone tetramethyl ether*, $C_{11}H_4O(O{\cdot}CH_3)_4$ (found, C = 65·57 ; H = 5·62, colourless needles, m. p. 211—213°), is prepared by the action of methyl sulphate. The acid obtained from purpurogallin trimethyl ether by means of alcoholic potash at 180° (*loc. cit.*) gives numbers (C = 62·87 ; H = 5·07) corresponding with the formula $C_{13}H_{12}O_5$, and is probably a derivative of *iso*purpurogallone. From purpurogallin tetramethyl ether, a similar compound can be prepared, and further work in this direction is now in active progress.

138. "The electrolytic oxidation of hydroxybenzoic acids." By Arthur George Perkin and Frederick Mollwo Perkin.

Twenty grams of gallic acid were dissolved in 100 c.c. of concentrated sulphuric acid, and the solution then diluted with about one-third its volume with water and electrolysed in the anode compartment of an electrolytic cell, when about 30 per cent. of a colouring matter was obtained which had the appearance of, but was not identical with, ellagic acid ; it gave an acetyl compound melting at 313—316°.

Protocatechuic acid, when treated in a similar manner, gave catellagic acid, $C_{14}H_6O_6$ (the yield being about 25 per cent.), the acetyl compound, $C_{14}H_4O_6(C_2H_3O)_2$, melted at 322—324°.

The electrolytic conditions employed were such as are generally used for preparing persulphuric acid, namely, moderately concentrated sulphuric acid and a high anode current density. By the electrolytic method, the catellagic acid obtained is purer than when potassium persulphate and sulphuric acid are employed. The reaction is being further studied, and will be extended to other hydroxybenzoic acids.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Frölich, O. Die Entwickelung der elektrischen Messungen. pp. xii + 192. Braunschweig 1905. (*Recd.* 6/6/05.)

From the Publishers.

Jenkins, J. H. B., and Riddick, D. G. Photographs to illustrate Messrs. Jenkins and Riddick's paper on "The microscopic examination

of metals." Published in "The Analyst" of January, 1905. (*Recd.* 5/6/05.) From the Editorial Committee of "The Analyst."

Nobel. Les Prix Nobel en 1902. pp. 181. ill. Stockholm 1905. (*Recd.* 6/6/05.) From the Royal Academy of Sciences, Sweden.

II. *By Purchase.*

Davy, Sir Humphry, Bart. Fragmentary remains, literary and scientific, with a sketch of his life and selections from his correspondence, edited by his brother John Davy. pp. viii + 330. London 1858. (*Recd.* 2/6/05.)

Delbrück, M., und Schrohe, A. Hefe, Gärung und Fäulnis. Eine Sammlung der grundlegenden Arbeiten von Schwann, Cagniard-Latour und Kützing, sowie von Aufsätzen zur Geschichte der Theorie der Gärung und der Technologie der Gärungsgewerbe. pp. 232. ill. Berlin 1904. (*Recd.* 9/6/05.)

Groth, P. Physikalische Krystallographie und Einleitung in die krystallographische Kenntnis der wichtigsten Substanzen. Vierte Auflage. pp. xiv + 820. Leipzig 1905. (*Recd.* 9/6/05.)

Jüptner, Hanns von. Lehrbuch der physikalischen Chemie für technische Chemiker und zum Gebrauche an technischen Hochschulen und Bergakademien. I Teil. Materie und Energie. II Teil. Chemisches Gleichgewicht und Reaktionsgeschwindigkeit. pp. 194, 358. Leipzig 1904, 1905. (*Recd.* 6/6/05.)

III. *Pamphlets.*

Attwood, George. Plant for the handling and treatment of ores at the Silver Cup and Nettie L. Mines, British Columbia. (From the Minutes of Proc. Inst. of Civil Engineers, **159**, 1904—1905.)

Cameron, Alexander T. The constitution of complex salts. I. Derivatives of the sesquioxides. (From the *Proc. Roy. Soc. of Edinburgh*, **25**, 1905.)

Dixon, Harold B. The nature of explosions in gases. (From the *J. Oxford University Junior Scientific Club, June*, 1903.)

Menschutkin, Boris N. M. W. Lomonossow, der erste russische Chemiker und Physiker. (From the *Annalen der Naturphilosophie*, **4**, 1905.)

Thomsen, Julius. Ueber den relativen Wert der zur Bestimmung der Verbrennungswärme flüchtiger organischer Verbindungen benutzten kalorimetrischen Methoden. (From the *Zeit. physikal. Chemie*, **51**, 1905.)

Thomson, R. T., and Dunlop, H. On the examination of cod liver oil and other fish liver oils. Glasgow 1905.

LIST OF FELLOWS, 1905.

The List of Fellows for 1905 is now in active preparation, and no change of address received after July 31st, 1905, can be included in it.

THE LIBRARY.

The Library will be closed for Stock-taking from **Monday, August 14th**, until **Saturday, August 26th**, 1905, inclusive.

Fellows are particularly requested to return all books belonging to the Library, **not later than Wednesday, August 9th.**

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Issued 10/11/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 299.

The following are abstracts of papers received during the vacation and published or passed for publication in the *Transactions*.

139. "Synthesis from glucose of an octamethylated disaccharide. Methylation of cane sugar and of maltose." By Thomas Purdie and James Colquhoun Irvine.

When a solution of tetramethyl glucose in pure benzene containing hydrogen chloride was heated at 105—115°, water was eliminated, and the rotatory power increased. The product, when distilled under reduced pressure, was a neutral dextrorotatory syrup without multirotation, which was devoid of action on Fehling's solution. The results of combustion and of methoxyl estimation agreed with the composition of an octamethylated disaccharide. Moreover, tetramethylglucose, which was recovered by heating the compound with dilute hydrochloric acid, appeared to be the sole product of the hydrolysis. These results indicate that condensation had occurred between two molecules of tetramethylglucose in the γ-oxide form, the product being an octamethyl glucosido-glucoside, which appears to be the first example of a synthesised disaccharide of the non-reducing type, represented by cane sugar and trehalose.

140. "Studies in the acridine series. Part II. Action of methyl iodide on benzoflavine." John Theodore Hewitt and John Jacob Fox.

The authors have extended their work on 2-amino-3 : 7-dimethylacridine (*Trans.*, 1904, **85**, 529) by an examination of benzoflavine

(2 : 8-diamino-3 : 7-dimethyl-5-phenylacridine). Acetylation with acetic anhydride and fused sodium acetate has furnished a *diacetyl* and small quantities of a *tetracetyl* derivative.

Diacetylbenzoflavine gives a *methiodide*, $C_{26}H_{26}O_2N_3I$; ammonia acts on this giving a *base* $C_{24}H_{23}ON_3$, one molecule of acetic acid being removed in addition to hydriodic acid.

By complete hydrolysis (that is, a removal of both acetyl groups), salts are obtained of which the *sulphate*, $(C_{22}H_{21}N_3)_2,H_2SO_4$, may be regarded as having a typical composition. The corresponding base does not contain oxygen, and since it lacks a carbinol hydroxyl its constitution must be regarded as para-quinonoid.

141. "Note on certain derivatives of *cyclo*propene." By David Trevor Jones.

The diethyl ester of methyl*cyclo*propenedicarboxylic acid and the corresponding dimethyl ester both readily take up two atoms of bromine, ethyl dibromomethyltrimethylenedicarboxylate thus obtained being a liquid (b. p. 185°/30 mm.), whilst the dimethyl bromo-ester is a solid (m. p. 77°). When warmed with zinc and acetic acid, these additive products yielded the *cyclo*propene esters from which they were derived.

When ethyl dibromomethyltrimethylenedicarboxylate is condensed with two molecules of ethyl sodiomalonate, a non-volatile product is obtained, which, on saponification with potassium hydroxide, yields small quantities of a tribasic acid, $C_9H_8O_8$ (m. p. 222°).

The intermediate non-volatile product appears to contain ethyl methyldi*cyclo*tetranetetracarboxylate, the acid, $C_9H_8O_8$, owing its formation to the splitting of a linking by potassium hydroxide with subsequent lactone formation.

142. "Experiments on the synthesis of the terpenes. Part V. Derivatives of *ortho*-cymene." By Francis William Kay and William Henry Perkin, jun.

Terpenes belonging to the *o*-series have not previously been prepared, and the authors described a series of experiments by which many members of this group have been obtained.

143. "Experiments on the synthesis of the terpenes. Part VI. Derivatives of *meta*-cymene." By William Henry Perkin, jun., and George Tattersall.

The authors dealt with some hitherto unknown members of the *m*-series of terpenes which have been obtained from various derivatives of *m*-toluic acid with the aid of organo-magnesium compounds.

144. "Topic axes and the topic parameters of the alkali sulphates and selenates." By Alfred Edwin Howard Tutton.

The conception of "topic axes," a combination of the crystallographical axes with the molecular volume, introduced independently by Muthmann in Germany and the author in this country, has proved of great value as an expression of the fundamental morphological structure of crystals. The author's surmise, published in 1894 (*Trans.*, 65, 659), as to the existence of relatively large interspaces between the structural units has now been proved to be a fact by the results of the determinations of the topic axes of the ammonium salts.

The importance of correctly diagnosing the type of homogeneous structure present in a crystallised substance is emphasised, and the suggestion of Fedoroff (*Zeit. Kryst. Min.*, 1902, 35, 129), that the type present in the crystals of the alkali sulphates and selenates is a pseudo-hexagonal one, is taken up and shown to be probably in accordance with fact, although the symmetry is strictly rhombic; for the primary prism angle is less than 1° removed from 60°, and the crystals frequently show a pseudo-hexagonal habit and form pseudo-hexagonal triplets.

A new series of topic axes has therefore been calculated for these salts on the assumption of a pseudo-hexagonal space lattice, employing densities freshly determined with the aid of the suspension method for the calculation of the molecular volume involved. The results demonstrate even more elegantly the laws already published by the author, governing the relations of the morphological constants with the atomic weight of the alkali metal, and with that of the dominant negative element (sulphur or selenium) present, as also the rule regarding the position of ammonium near rubidium in the alkali series and the interesting corollary as to the existence of intermolecular and interatomic spaces.

145. "The relation of position isomerism to optical activity. IV. The rotation of the menthyl esters of the isomeric nitrobenzoic acids." By Julius Berend Cohen and Henry Percy Armes.

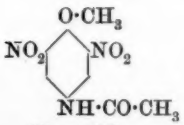
The previous observations on the effect of position isomerism on the rotation of menthyl benzoate have been confirmed. The *p*-nitro-group has the least, the *o*-nitro-group the greatest effect on the rotation, whilst the effect of the *m*-nitro-group lies between the two. The most striking difference in the effect of the nitro-group and that of the halogens previously studied (*Trans.*, 1903, **83**, 1213; 1904, **85**, 1262) is that whereas the ortho-chlorine and -bromine atoms diminish the amount of deviation, the *o*-nitro-group enormously increases it.

146. "Dinitroanisidines and their products of diazotisation." By Raphael Meldola and Frank George Coad Stephens.

This paper is in continuation of former work on the elimination of a nitro-group on diazotisation and has been carried out in order to ascertain whether this elimination follows the ortho-para rule. The authors have found that when dinitro-*o*-anisidine is diazotised in presence of sulphuric acid and the product decomposed by heating with hydriodic acid there is obtained a mixture of a new iododinitroanisole ($C_6H_2 \cdot OCH_3 \cdot I \cdot NO_2 \cdot NO_2 = 1:2:4:5$), melting at 146—147°, and the iodonitroresorcinol methyl ether (m. p. 115—116°) formerly described. This result shows that under the conditions of diazotisation specified there results a mixture of a diazonium salt and a quinone-diazide (diazo-oxide). By the nitration of the monacetyl derivative of *p*-aminophenol the authors have obtained, in accordance with the results recently published by Reverdin (*Arch. Sci. phys. nat.*, 1905, **19**, 353), the acetyl derivative of the *iso*picramic acid

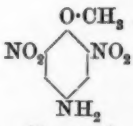
$$(C_6H_2 \cdot OH \cdot NO_2 \cdot NH_2 \cdot NO_2 = 1:2:4:6)$$

of Dabney (*Amer. Chem. J.*, 1883, **5**, 33). On methylation, this acetyl derivative yields a new dinitroacetanisidide which, on hydrolysis, gives a new dinitroanisidine:



M. p. 157°.

I.



M. p. 212°.

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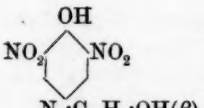
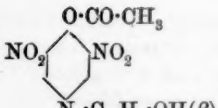


M. p. 269—270°.

III.



M. p. 259°.

IV.

The latter on diazotisation does not lose a nitro-group, but the methyl of the methoxy-group is eliminated with the formation of the dinitroquinonediazide. The latter couples with β-naphthol in alkaline solution to form the azo-compound (III), the acetyl derivative of the latter (IV) being readily formed by heating the compound for a few minutes with acetic anhydride.

The authors have also prepared the dinitroacetanisidide and dinitroanisidine corresponding to the new dinitroaminophenol recently described by Reverdin.

147. "Labile isomerism among benzoyl derivatives of salicylamide." By Arthur Walsh Titherley and William Longton Hicks.

A compound erroneously described by one of the authors (*Trans.*, 1902, **81**, 1533) as salicylbenzamide, $OH{\cdot}C_6H_4{\cdot}CO{\cdot}NH{\cdot}CO{\cdot}C_6H_5$, melting at 120°, which was obtained in the condensation of methylsalicylate and sodium benzamide, was shown to be a peculiar double compound of benzamide and salicylic acid, and *N*-benzoylsalicylamide has not yet been isolated. There are, however, two *o*-benzoyl derivatives of salicylamide, one melting at 208°, obtained in the above condensation, which is identical with the compound described by Gerhardt and Chiozza (*Ann. Chim. Phys.*, 1856, **46**, 139), the other (m. p. 144°) obtained by the authors by the wet benzoylation of salicylamide by benzoyl chloride in presence of sodium carbonate. Neither gives any coloration with ferric chloride and there is strong evidence that in both compounds the benzoyl group is attached to phenolic oxygen. The more fusible isomeride is labile and passes with remarkable ease into the other, the transformation in most cases being quantitative.

The change, however, is not reversible, and of the two it is the labile compound which must possess the ordinary amide structure, $BzO{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$, since only the stable form, *o*-benzoylsalicyliminohydroxide, $BzO{\cdot}C_6H_4{\cdot}C(OH){:}NH$, yields metallic salts.

Both forms on benzoylation in pyridine yield the same *O*-*N*-dibenzoylsalicylamide, $BzO{\cdot}C_6H_4{\cdot}CO{\cdot}NHBz$ (m. p. 129°), the stable substance giving a theoretical yield, the labile isomeride furnishing a much smaller proportion owing to simultaneous production of benzoyl-

salicylnitrile. There is evidence of the existence of two forms of the dibenzoyl derivative in equilibrium when the stable form melting at 129° is fused. On rapidly cooling, a brittle, amorphous glass is obtained which melts at 55—60°, solidifies again at 85°, and then melts at 128°.

148. "Preparation of benzeneazocoumarin; its bearing on the constitution of *p*-hydroxyazo-compounds." By Herbert Victor Mitchell.

The existence, and extreme ease of formation, of benzeneazocoumarin and the three nitrobenzeneazocoumarins favours the view that the *p*-hydroxyazo-compounds are really phenolic in character and not derivatives of quinonephenylhydrazone.

149. "The combustion of acetylene." By William Arthur Bone and George William Andrew.

The authors' experiments proved that (1) the combustion of acetylene does not involve the preferential oxidation of either carbon or hydrogen. Separation of carbon or hydrogen, when it does occur, must be entirely ascribed to secondary thermal decompositions.

(2) Carbon monoxide and formaldehyde simultaneously arise at an early stage of the process, probably as the result of the decomposition of an unstable primary product $C_2H_2O_2$, such as $\begin{matrix}C\cdot OH\\ \vdots\\ C\cdot OH\end{matrix}$. The formation of formaldehyde certainly precedes that of steam. The whole process may be represented by the following scheme:

$$\begin{matrix}C\cdot H\\ \vdots\\ C\cdot H\end{matrix} \rightarrow \left[\begin{matrix}C\cdot OH\\ \vdots\\ C\cdot OH\end{matrix}\right] \rightarrow \underbrace{CO + H\cdot C{:}O}_{CO+H_2} \rightarrow \underbrace{HO\cdot C{:}O}_{CO+H_2O} \rightarrow \underbrace{HO\cdot C{:}O}_{CO_2+H_2O}$$

Stage 1. 2. 3. 4.

Below the ignition point, the formic and carbonic acids produced at stages 3 and 4 respectively break down, forming steam and oxides of carbon, whilst above the ignition point the formaldehyde produced at stage 2 (or possibly also the dihydroxyacetylene at stage 1) is resolved into carbon monoxide and hydrogen. The explosive combustion may therefore be represented by the empirical equation $C_2H_2 + O_2 = 2CO + H_2$ (see Bone and Cain, *Trans.*, 1897, **71**, 26).

(3) Below the ignition point, excess of oxygen over and above an equimolecular proportion always retards the combustion. This was also shown to hold good above the ignition point by H. B.

Dixon in his experiments on the rates of explosion of acetylene-oxygen mixtures (*Phil. Trans.*, 1893, **184**, 183).

(4) In contact with a hot catalysing surface, such as porous porcelain, acetylene unites with steam, forming acetaldehyde. This action may take place even in presence of oxygen, and introduces a complication whenever the hydrocarbon is being burnt over a hot surface. In such circumstances, the secondary decomposition of acetaldehyde might give rise to methane, or even carbon and hydrogen and carbon monoxide, thus: $CH_3 \cdot CHO = \underbrace{CH_4 + CO}_{C + 2H_2}$ (Bone and Smith, *Trans.*, 1905, **87**, 910).

(5) Benzene is not produced in presence of oxygen below the ignition point.

150. "Studies on the origin of colour-derivatives of fluorene." By Ida Smedley.

Experiments were made with the object of throwing further light on the question, under what conditions in ketonic compounds can halogens play the part of oxygen in contributing to the formation of coloured substances. The results supported the view that the power of the carbonyl group to act as a chromophore is destroyed by replacing the oxygen by two chlorine atoms; the effect of the other halogen atom requires further elucidation. Fluorenone chloride (m. p. 103°) was prepared and was found to be colourless, but attempts to replace the chlorine by iodine atoms were unsuccessful. Fluorenone, fluorenone chloride, and 9:9-dihydroxydiphenylfluorene (m. p. 223—224°) exhibit in a marked degree the property of "halochromism" when dissolved in concentrated sulphuric acid. The action of alcoholic potassium hydrosulphide on fluorenone chloride produced a colourless disulphide (m. p. 161°); the similar action of alcoholic potassium sulphide did not form a thio-ketone, as was expected, but produced the red hydrocarbon, bisdiphenylene-ethylene, and fluorenone.

151. "Note on the Zeisel reaction in the case of di-ortho-substituted phenolic ethers." By David Runciman Boyd and John Edmund Pitman.

Pyrogallol trimethyl ether is readily decomposed by aqueous hydriodic acid (sp. gr. 1·6), giving the theoretical yield of methyl iodide after heating for 45 minutes.

Trichloroanisole and tribromoanisole, on the other hand, are left for the most part unaffected by such treatment. If, however, the solu-

bility of these ethers is secured by employing, instead of aqueous hydriodic acid, a mixture of about equal volumes of hydriodic acid with glacial acetic acid, decomposition is complete after an hour's heating, and a theoretical yield of methyl iodide is obtained.

152. "The mechanism of the hydrogen sulphide reduction of nitro-compounds." By Julius Berend Cohen and Douglas McCandlish.

In the process of reducing different nitro-compounds with ammonium sulphide, or, as it is usually effected, with hydrogen sulphide in an alcoholic solution containing ammonia, great differences are noticeable in the rate of reduction, in the conditions under which reduction takes place, and in the nature of the products formed. From a study of upwards of forty different nitro-compounds, the authors have laid down the following empirical rule: *the rate of reduction is increased by the presence of acidic* (NO_2, CO_2Me, Cl) *groups and diminished by that of basic groups* (CH_3, NH_2), *and is further affected by steric hindrance.* The authors show further that the reduction occurs in at least two well-defined steps, the first being attended by the formation of a hydroxylamine compound, which is easily identified by its property of liberating iodine from potassium iodide.

153. "The arylsulphonyl-*p*-diazoimides." By Gilbert Thomas Morgan and Frances Mary Gore Micklethwait.

The new series of arylsulphonyl-*p*-diazoimides (*Trans.*, 1905, **87**, 74 and 921) has been extended by the preparation and investigation of *toluene*-p-*sulphonyl*-p-*phenylenediazoimide*, 1 : 3-*xylene*-4-*sulphonyl*-p-*phenylenediazoimide*, and the more complex *benzene*-1 : 3-*disulphonyl-bis*-p-*phenylenediazoimide*, $C_6H_4{:}[N_3]{\cdot}SO_2{\cdot}C_6H_4{\cdot}SO_2{\cdot}[N_3]{:}C_6H_4$.

A detailed examination of the first of these compounds showed that (1) the molecular complexity of the arylsulphonyl-*p*-diazoimides corresponds with the simplest empirical formula for these substances; (2) cold mineral acids and even glacial acetic acid bring about a disruption of the *p*-diazoimido-complex; (3) the *p*-diazoimides readily yield azo-derivatives when condensed in an inert solvent with the phenols and the more reactive aromatic amines, and (4) when treated with caustic alkalis, preferably in alcoholic solution, the diazo-nitrogen of these diazoimides is eliminated and replaced by hydrogen.

154. "The reversibility of photographic development and the retarding action of soluble bromides." By Samuel Edward Sheppard.

It was shown experimentally that development is a *reversible* chemical reaction, and for ferrous oxalate the equilibrium factors were determined quantitatively. The retarding action of bromides enabled the parts played by diffusion and chemical action to be defined, and a general theory of development on this basis was brought forward.

155. "Studies in chlorination. III. The progressive chlorination of benzene in presence of the aluminium-mercury couple." By Julius Berend Cohen and Percival Hartley.

In the present paper a description is given of the products obtained by the progressive chlorination of benzene from the monochloro- to the pentachloro-derivative. The results confirm the general rule which has been found to obtain in the case of the chlorotoluenes and the chloronitro-derivatives of benzene and toluene (*Trans.*, 1902, **81**, 1326, 1345; 1904, **85**, 1276; 1905, **87**, 320), and which may be expressed as follows:

The third substituent (chlorine atom or nitro-group) entering the dichloro- or chloronitro-benzenes or the monochlorotoluenes occupies the unsymmetrical position, forming a 1 : 2 : 4-compound; the fourth substituent (Cl or NO_2) occupies position 5.

In all the vicinal (1 : 2 : 3) chloro- or chloronitro-derivatives of benzene and toluene, the fourth substituent (Cl or NO_2) is adjacent to the other three.

There is no marked exception to this rule, which, in the majority of cases, has reference to the only product of the reaction in question; in a few cases to the main product.

156. "The interaction of sulphuretted hydrogen and arsenic pentoxide in the presence of hydrochloric acid." By Francis Lawry Usher and Morris William Travers.

It has been found that in absence of hydrochloric acid, or in presence of very small quantities of that reagent, arsenic pentoxide is rapidly reduced, so that the reaction results in the formation of the trisulphide. With increasing concentrations of the acid, up to 25 per cent. strength, the product is the pentasulphide. In the case of the reaction between arsenic pentoxide and sulphur dioxide in solution, hydrochloric acid exerted a similarly marked influence in retarding the rate at which the reduction took place.

In presence of concentrated hydrochloric acid, the reaction results in the formation of the trisulphide. It was proved that in this case one has to consider the reaction of the arsenic pentoxide with the hydrochloric acid as taking place much more rapidly than that which would result in the formation of the pentasulphide. The reaction of the arsenious compound and the chlorine with the sulphuretted hydrogen is practically instantaneous.

157. "Studies in asymmetric synthesis. III. The asymmetric synthesis of *l*-lactic acid. The optical activity of fermentation lactic acid." By Alexander McKenzie.

Samples of fermentation lactic acid from various firms were examined polarimetrically and found to be sometimes dextrorotatory and sometimes lævorotatory. The author supposed that a mixture of unequal amounts of *d*- and *l*-lactic acids is invariably produced in the production of lactic acid from sugar by bacterial agency. Active lactic acid is not so readily racemised by alkali as is active mandelic acid.

The asymmetric synthesis of *l*-lactic acid was accomplished by reducing *l*-menthyl pyruvate with aluminium amalgam, when a mixture of unequal amounts of *l*-menthyl *d*-lactate and *l*-menthyl *l*-lactate, containing an excess of the latter, is formed. When this mixture is hydrolysed by an excess of alcoholic potassium hydroxide and the *l*-menthol removed, a dextrorotatory potassium salt, containing an excess of *l*-lactate over *d*-lactate, is produced; this mixture, on acidification by a mineral acid, becomes lævorotatory and forms a dextrorotatory zinc salt.

158. "The action of phenylpropiolyl chloride on ketonic compounds." By Siegfried Ruhemann and Richard William Merriman.

By the action of phenylpropiolyl chloride on the mono-sodio-derivative of ketonic compounds, the acetylenic ketones are not formed, but compounds which are shown to be derivatives of dihydrofurfuran. With the acid chloride, thus mono-sodioacetylacetone yields acetylbenzylidenemethylketodihydrofurfuran (m. p. 152—153°).

Although insoluble in alkali hydroxides or carbonates, this compound is readily decomposed by these reagents. In secondary bases, such as piperidine, it dissolves with development of heat to yield deep blue solutions, from which hydrochloric acid precipitates an isomeric substance, 2-acetyl-5-hydroxy-4-phenyl-3-methyl-1-keto*cyclo*pentadiene (m. p. 170°), crystallising from alcohol in red plates.

This red isomeride has acidic properties, dissolving in piperidine and

alkali hydroxides or carbonates, yielding blue solutions, in which, however, it is very unstable, the colour changing to yellow, slowly in the cold but readily on warming. The solution then yields, with hydrochloric acid, the colourless acetylphenylmethyl*cyclo*butadienecarboxylic acid, also isomeric with the former compounds. Under the influence of cold concentrated sulphuric acid, the acid is transformed into an orange compound (m. p. 216—217°), to which the name indone*cyclo*methylacetoethylene has been given. This substance dissolves in aqueous alkalis, especially on warming, yielding violet solutions.

Ethyl 5-benzylidene-2-methyl-4-ketodihydrofurfuran-3-carboxylate, the product of the action of phenylpropiolyl chloride on ethyl monosodioacetoacetate, is analogous to the yellow compound, $C_{14}H_{12}O_3$; it also dissolves in piperidine to yield a blue solution from which hydrochloric acid precipitates a red solid similar in properties to the red compound, $C_{14}H_{12}O_3$.

The action of phenylpropiolyl chloride on ethyl mono-sodiomalonate furnished a yellow compound (m. p. 174—175°), which is either

$$\left.\begin{matrix} C_6H_5\cdot C\vdots C\cdot CO \\ C_6H_5\cdot C\vdots C\cdot CO \end{matrix}\right\rangle C(CO_2Et)_2 \text{ or } \left.\begin{matrix} C_6H_5\cdot C\!:\!C\cdot CO \\ C_6H_5\cdot C\!:\!C\cdot CO \end{matrix}\right\rangle C(CO_2Et)_2,$$

together with the anhydride of 1 : 2-diphenyl*cyclo*butadiene-3 : 4-dicarboxylic acid.

159. "The influences regulating the reproductive functions of *Saccharomyces cerevisiæ*." By Adrian John Brown.

The paper described the results of a continued investigation of phenomena associated with the reproductive functions of the yeast-cell to which attention had been previously called by the author (Trans., 1892, **61**, 369; and 1894, **65**, 911).

160. "Molecular refractions of some liquid mixtures of constant boiling point." By Ida Frances Homfray.

Mixtures of aldehyde and water give values of specific refraction less than those calculated from the constituents, and these differences form a regular series passing through a maximum. The molecular refraction of aldehydrol, $CH_3\cdot CH(OH)_2$, should be less than that of acetaldehyde *plus* water, on account of the change of the oxygen atom from the carboxylic to the hydroxylic condition. The presence of aldehydrol, together with free aldehyde and water, is therefore confirmed, and an approximate estimate of the relative amounts has been made.

Formic acid and water do not appear to combine at the ordinary

temperature to form orthoformic acid. Acetone and water show a partial, but only slight, tendency to combination as $CH_3 \cdot C(OH)_2 \cdot CH_3$.

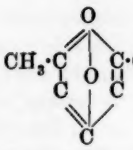
Gautier has given reasons for considering that a definite chemical compound is formed, consisting of one molecule of ethyl cyanide and three of alcohol, and that this is the distillate obtained in preparing ethyl cyanide by Pelouze's method.

The refractive indices of a number of mixtures of different concentrations have now been measured and the experimental curve so constructed used to determine the composition of the distillates under atmospheric pressure and under a series of lower pressures. In the former case, Gautier's result is confirmed, but when the pressure is reduced, the distillate contains more cyanide. The density and specific and molecular refractions of the mixture agree with those calculated from the constituents.

The conclusion is, therefore, that no compound is formed, and that this is a case of mutually soluble liquids of maximum vapour pressure. Cryoscopic determinations in benzene gave normal depression in the case of ethyl cyanide, but small values for alcohol and for the mixture of constant boiling point. Reasons are, however, given for attributing this, in both cases, to reduction of osmotic pressure rather than to molecular association or combination.

161. "Molecular refractions of dimethylpyrone and its allies, and the quadrivalency of oxygen." By Ida Frances Homfray.

In most cases of associated compounds containing oxygen, the quadrivalency of that element is probable, and the observed molecular refractions are always in excess of those derived from the additive constants. The inference is that the atomic refraction of quadrivalent oxygen is greater than the highest of the values for the bivalent atom. No satisfactory data have been published for the determination of this constant, and the compounds which appear to afford the best opportunity for such investigation are dimethylpyrone and its allies and derivatives. Accordingly, the molecular refractions of the following easily purified substances have been determined, and all data are given. Dimethylpyrone and its hydrochloride, the compound of dimethylpyrone and alcohol, diacetylacetone, pyrone and its hydrochloride, pyromeconic acid, ethyl chelidonate, ethyl xanthochelidonate, and dehydracetic acid. Measurements were made in solution in various solvents, the specific refraction of the solute being deduced in the usual way. The possible error is estimated at about one per cent. When the usual formulæ, not involving quadrivalent oxygen, are used, the calculated molecular refractions are in all cases considerably too low. The modified formula for dimethylpyrone proposed

by Professor Collie is  , and all the other compounds examined here may be expressed by analogous formulæ. The atomic refraction of quadrivalent oxygen for the D-spectral line required by these formulæ to satisfy the experimental numbers has been found by subtraction in each case, and a good agreement between these values is obtained, the mean being 2·73.

The molecular refractions recalculated with this number for quadrivalent oxygen agree in most cases with the experimental to within the limit of accuracy of measurement.

162. "The alkylation of mannose." By James Colquhoun Irvine and Agnes Marion Moodie.

α-Methylmannoside has been alkylated in methyl-alcoholic solution by means of silver oxide and methyl iodide with the production of a crystalline tetramethyl α-methylmannoside, and this compound, when hydrolysed by means of dilute hydrochloric acid, was converted into tetramethyl mannose.

The alkylated sugar proved to be a colourless syrup, and when heated with methyl alcohol containing 0·25 per cent. hydrochloric acid it behaved like mannose, producing only the α-modification of the corresponding mannoside. Consequently the crystalline tetramethyl α-methylmannoside was the sole product of the reaction. When the alkylation was effected by means of silver oxide and methyl iodide, however, a different result was obtained. The product was a colourless, lævorotatory liquid, and this was shown to consist of a mixture of the α- and β-modifications of the fully methylated methylmannoside. The β-isomeride differs from the α-form in its lævorotation and in its ready hydrolysis by means of dilute hydrochloric acid or by the action of emulsin.

163. "The interaction of acridines with magnesium alkyl halides." By Alfred Senier, Percy Corlett Austin, and Rosalind Clarke.

By the application of Grignard's reaction to acridine and its homologues, a series of coloured crystalline compounds has been obtained. Endeavours to replace the metal magnesium by calcium were, however, unsuccessful, for in attempting to prepare calcium alkyl and aryl halides a change resembling Fittig's reaction always

occurred almost exclusively (compare Beckmann, *Ber.*, 1905, **38**, 904). The magnesium compounds, although readily formed, were very difficult to obtain in a pure state on account of their insolubility in inert solvents, and they were decomposed by glacial acetic acid, alcohol, and chloroform, the alcoholic solution yielding the original acridine.

On employing as solvents for the reagents ethers of high boiling points, such as anisole and phenetole, or mixtures of either of these with ordinary ether, compounds of definite composition slowly crystallised. These products, which frequently change in colour on drying, retain variable proportions of ether, but this can be entirely removed by drying at 110—115°.

Most of the compounds examined were of the type of the diacridine hexahalides previously described (*Trans.*, 1904, **85**, 1199), and consist of two molecules of the base united with three molecules of the "reagent." In the case of hexamethylacridine, however, the type is that of the tetrahalides, one molecule of base combining with two of the "reagent."

164. "New method of determining molecular weights." By Philip Blackman.

Isotonic solutions of different substances in the same solvent having equal vapour pressures, it follows that if two solutions connected by vapour be allowed to attain equilibrium, their final volumes (v_1, v_2) will be inversely proportional to the number of dissolved molecules. This state of equilibrium is represented by the equation $\frac{m_1}{m_2} = \frac{w_1}{w_2} \cdot \frac{v_2}{v_1}$ (where m_1, m_2, are the molecular weights of the substances, the weights, w_1, w_2, of which are dissolved in the volumes, v_1, v_2, of the same solvent).

The apparatus consists of two graduated test-tubes connected by a T-piece, with a bulb in each of the limbs of the U-piece. The substances are introduced into the test-tubes, the solvent added, and the solutions boiled. After a time, several readings of the volumes (v_1, v_2) are taken, and the molecular weight calculated from the foregoing equations. With careful boiling, good results can be obtained in remarkably short times.

165. "Benzylphenylallylmethylammonium compounds. A complete series of four optically active salts." By Alfred William Harvey.

l-Benzylphenylallylmethylammonium *l*-camphorsulphonate has been prepared, having a molecular rotatory power of an equal arithmetical

value to that of its dextro-isomeride, and a series of salts of the optically active base combined with optically active camphorsulphonic acids have been obtained of the type :

dBdA ; *lBlA* ; *dBlA* ; *lBdA*.

The method of effecting the resolution of the iodide of the externally compensated base has been somewhat modified, whereby the difficulties previously experienced have been obviated (compare *Trans.*, 1899, **75**, 1127, and 1901, **79**, 828).

166. "Solid solutions." By Reinhold Frederick Korte.

Experiments were made to determine whether barium sulphate precipitated in presence of a ferric salt forms a solid solution of ferric iron, or whether a ferrisulphate of barium is produced. The results showed that the amount of iron carried down with the barium sulphate does not increase in weight above a very small amount (about 1·3 per cent.), however much of the ferric salt be present ; also that there is a loss on ignition, implying the decomposition of an iron sulphate. Probably the point of saturation of barium sulphate with ferric iron is one in which the latter is present to only a minute extent, and it is also not impossible that the state of the ferric salt is that of a ferric sulphate.

The precipitation of calcium as oxalate in presence of salts of magnesium was next examined. Here, when the proportion of magnesium to calcium oxide exceeds 36MgO to 5CaO, a sudden rise in the proportion of magnesium to calcium takes place, from about 4·7 to 13·7 per cent. The magnesium is evidently present in the state of solid solution, and, although magnesium oxalate is an easily soluble salt, yet it cannot be removed from the calcium oxalate precipitate by washing.

In precipitating ferric hydroxide with ammonia in presence of a manganous salt, saturation of the ferric hydroxide with manganese takes place, when the proportion between Fe_2O_3 and MnO in solution is 5 : 1. A larger proportion of manganese in solution produces no change in the amount retained by the ferric precipitate, namely, 2 per cent. The absorption of small amounts of manganese by iron is nearly complete, being as much as 95 per cent. From this it follows that on redissolving and reprecipitating a ferric precipitate containing only a small proportion of manganese, little change in its composition takes place.

Ferric hydroxide also dissolves nickelous oxide, and a saturated solution is produced when the proportion between Fe_2O_3 and NiO in solution is 5·9 to 1.

Although manganous and nickel oxides are carried down with aluminium hydroxide, no regularity could be observed; solid solution appears not to take place, but merely mechanical absorption by the gelatinous alumina.

Lead sulphate, precipitated in presence of other salts, does not carry down any metals in solid solution.

167. "The bromo-derivatives of camphopyric acid." By John Addyman Gardner.

When *cis*-camphopyric acid is treated with bromine in the presence of phosphorus pentachloride and the mixture poured into water, the chief products are *cis*-bromocamphopyric acid and *cis*-bromocamphopyric anhydride, a small quantity of *trans*-bromocamphopyric acid being also formed.

If, however, camphopyric anhydride is used instead of camphopyric acid, the chief products are *trans*-bromocamphopyric acid and bromocamphopyric anhydride, little or no *cis*-bromocamphopyric acid being produced.

trans-Camphopyric acid, treated in a similar way, using phosphorus trichloride instead of pentachloride, yields mainly *cis*-bromocamphopyric acid, a little anhydride, but no *trans*-bromo-acid.

The *cis*-acid is readily convertible into its anhydride by the action of acetyl chloride, but the *trans*-acid is not affected by this reagent. On the other hand, *cis*-bromocamphopyric anhydride, on boiling with water, is converted into a mixture of *trans*-bromocamphopyric acid and decomposition products, probably of the *cis*-acid.

The bromine atom is readily replaceable. By the action of nascent hydrogen, *trans*-bromocamphopyric acid yields *trans*-camphopyric acid, whilst both *cis*-bromocamphopyric acid and *cis*-bromocamphopyric anhydride give ordinary camphopyric acid. Under the influence of alkalis, the bromine atom in both acids may be replaced by hydroxyl.

168. "The reduction of metallic oxides by aluminium carbide." By John Norman Pring.

Alloys of aluminium can be prepared by direct reduction of the oxide by carbon in presence of many other metals, whereas without such auxiliary metals the product consists chiefly of aluminium carbide. These considerations led to a detailed study of the reactions between aluminium carbide and metallic oxides and metals. It was found that the carbide behaves as a strong reducing agent. Up to 1400°, both the aluminium and the carbon are simultaneously oxidised, forming alumina, carbon dioxide, and the metal of the oxide. At higher

temperatures, however, selective reduction becomes apparent, the reduction being more and more brought about by the carbon of the carbide the higher the temperature of reaction, the result being that alloys of aluminium and the reduced metal are obtained, the percentage of aluminium increasing with the temperature and, in the case of iron, finally reaching the limit demanded by the equation

$$Fe_2O_3 + Al_4C_3 = 2Fe. \quad 4Al + 3CO.$$

Calcium carbide was found to exhibit a similar behaviour, but to a less marked degree, interaction between lead oxide and excess of molten calcium carbide giving an alloy containing 2·6 per cent. of calcium.

Aluminium carbide reacts with metals at temperatures above the melting point of platinum to form aluminium alloys with liberation of free carbon; at higher temperatures, the reaction takes place with violence and is complete.

A study of the action of metallic calcium on aluminium carbide showed that calcium carbide is formed at all temperatures above the melting point of platinum, and as aluminium acts on calcium carbide producing aluminium carbide, the reaction is probably reversible.

169. "The rusting of iron." By Wyndham Rowland Dunstan, Hooper Albert Dickinson Jowett, and Ernest Goulding.

A detailed account is given of the investigation on the rusting of iron, an outline of which has been already published (Dunstan, Proc., 1903, **19**, 150).

170. "Studies in comparative cryoscopy. Part III. The esters in phenol solution." By Philip Wilfred Robertson.

The molecular depressions of the esters in phenol solution tend to increase with the concentration. In many instances, however, there is an initial association, that is, the molecular depression first decreases, so that under these conditions a minimum is exhibited in the molecular depression curve.

The concentration at which the minimum occurs is a characteristic for each ester, but is greater in the case of esters of high molecular weight. The initial association of these compounds becomes more rapid as the molecular weight increases.

The ethyl esters of the normal fatty acids differ from odd to even members of the series, but each division forms a perfectly definite series. Thus, in the case of the compounds with an even number of

carbon atoms, the initial molecular depression reaches a maximum at the sixth member, falls to a minimum at the twelfth, and then rises to a second maximum when the chain contains sixteen carbon atoms.

The esters derived from polybasic acids are characterised by the following behaviour.

(1) Their molecular depressions increase rapidly with the concentration.

(2) The minimum in the molecular depression curve is not always exhibited.

(3) They have extremely high initial molecular depressions.

The negative "rate" of association and the abnormally high molecular depressions of the esters are probably due to the great tendency of phenol to form molecular complexes, since, in the case of the substituted phenols, thymol, guaiacol, and *o*-nitrophenol, which are not so strongly associated, these irregularities tend to disappear.

171. "The iodides of copper."
By James Wallace Walker and Mary Violette Dover.

When equivalent solutions of potassium iodide and copper sulphate are mixed, the resulting precipitate seems to contain a definite polyiodide of copper mixed with the cuprous iodide, and not, as has been hitherto assumed, free iodine. Treatment of this precipitate with water gives a deep red solution, the analyses of which point to the formula CuI_4 for the solid polyiodide. From a study of the equilibrium between this solution and cuprous iodide, the authors conclude that it contains an equimolecular mixture of CuI_2 and CuI_6. The limit of concentration of pure cupric iodide solution is almost exactly 0·1 per cent., removal of the water even in the form of ice inducing the reaction $6CuI_2 \rightleftharpoons CuI_6 + 5CuI$. Even higher polyiodides than these can be obtained from alcoholic solution.

172. "The interaction of alcohols and phosphorous halides."
By James Wallace Walker and Frederick Murray Godschall Johnson.

The authors have studied the yield of alkyl halide obtained in the action of phosphorous chloride, bromide, and iodide on methyl, ethyl, and *n*-propyl alcohols, in the hope of finding a general equation such as $PX_3 + 3A{\cdot}OH = P(OA)_{3-y}(OH)_y + (3-y)HX + yAX$, applicable to the several cases. In this equation, X represents a halogen atom and A an alkyl group. In the production of methyl and *n*-propyl bromides and of ethyl iodide, the value of y is 2; in the case of ethyl chloride, it is 1. In the other instances, the above equation would require to be doubled to express the results. The high degree of solubility of yellow

phosphorus in methyl iodide suggested a ready method for the production of that substance in quantity. The theoretical weight of iodine is added to a 10 per cent. solution of phosphorus in methyl iodide, and the equivalent amount of alcohol is slowly introduced. Enough phosphorus is then dissolved in the resultant liquid to produce again a 10 per cent. solution and iodine and alcohol are added as before. By continuing this process a large quantity of methyl iodide may be obtained in a short time, the yield being 94 per cent. of the theoretical. Only 65 per cent. of the theoretical yield of ethyl iodide was obtained by this method. Instead of employing the phosphorus and iodine in the ratio required for the production of the tri-iodide, an almost equally good result is obtained by adding enough iodine to produce the penta-iodide, this compound being much more soluble than the tri-iodide in methyl iodide.

173. "The electrical conductivities of some salt solutions in acetamide." By James Wallace Walker and Frederick Murray Godschall Johnson.

The salts examined were mercuric chloride, potassium chloride, iodide, and cyanide. Of these, the first is the only normal electrolyte, the others showing a maximum of molecular conductivity at about 30 or 40 litres, which then falls to about half value on dilution. Mercuric chloride is known to give a compound with acetamide and potassium iodide is found to yield the compound $KI,6CH_3{\cdot}CO{\cdot}NH_2$. The migration ratio of the iodion is found to be greater than in aqueous solution a fact which points to combination of the ions with the solvent.

174. "Contributions to our knowledge of the aconite alkaloids. Part XVI. Indaconitine, the alkaloid of *Aconitum chasmanthum*." By Wyndham Rowland Dunstan and Albert Edward Andrews.

Indaconitine is a highly poisonous alkaloid which has been obtained from the Indian plant known as "mohri," at first thought to be the same as the European *Aconitum Napellus*, but now recognised as a distinct species, *Aconitum chasmanthum*. In this paper a full account is given of the properties of the alkaloid and of its principal salts.

Indaconitine ($C_{37}H_{47}O_{10}N$) is a crystalline alkaloid very closely resembling aconitine from *Aconitum Napellus* in its general properties, but differing, however, in its habit of crystallisation and in many of its physical properties. Most of the salts crystallise well and are distinct from the corresponding aconitine salts. Its physiological action has been shown to closely resemble that of aconitine and pseudaconitine (Cash and Dunstan, *Proc. Roy. Soc.*, 1905).

Indaconitine undergoes hydrolysis in two stages, in the first of which an acetyl group is eliminated as acetic acid, with the formation of a base, indbenzaconine, which has not been crystallised, but furnishes crystalline salts. This hydrolysis is represented by the equation:

$$C_{34}H_{47}O_{10}N + H_2O = C_2H_4O_2 + C_{32}H_{45}O_9N.$$

Indbenzaconine is practically non-poisonous. On further hydrolysis, indbenzaconine furnishes benzoic acid and pseudaconine identical with the final hydrolytic product of pseudaconitine.

Indaconitine is therefore of interest as representing a type of highly toxic alkaloid intermediate in its properties between the aconitine of the common European aconite (*A. Napellus*) and the pseudaconitine derived from the Indian aconite of Nepal. The discovery of this alkaloid and its proximate constitution has led the authors to change the formula of pseudaconitine from $C_{36}H_{49}O_{12}N$, the formula originally assigned to the alkaloid by Wright, to $C_{36}H_{51}O_{12}N$.

175. "Contributions to our knowledge of the aconite alkaloids. Part XVII. Bikhaconitine, the alkaloid of *Aconitum spicatum*." By Wyndham Rowland Dunstan and Albert Edward Andrews.

This alkaloid, like indaconitine described in the previous communication, is highly poisonous. It has been isolated from a supposed variety of *Aconitum ferox* of India, which has now been proved to be a distinct species, *Aconitum spicatum*. The vernacular name of the plant being "bikh," the name bikhaconitine is proposed for the new base.

Bikhaconitine ($C_{36}H_{51}O_{11}N$) does not crystallise so readily as other "aconitines," and its physical properties are distinct. A number of its salts have been prepared, and most of them crystallise well. Its physiological action very nearly resembles that of the other aconitines: its toxicity towards warm-blooded animals is greater than that of either aconitine or japaconitine, but is slightly inferior to that of pseudaconitine, which is the most poisonous alkaloid of the group.

Bikhaconitine, like the other aconitines, undergoes hydrolysis in two stages. In the first of these, an acetyl group is eliminated as acetic acid, forming a new base (veratroylbikhaconine). This alkaloid does not crystallise, but furnishes crystalline salts. On further hydrolysis, veratroylbikhaconine furnishes veratric acid and bikhaconine, which does not crystallise, but furnishes crystalline salts. This alkaloid differs from other "aconines" previously described.

The paper contains a full account of the properties of bikhaconitine, its salts and derivatives, and a comparison of their properties with

those of the other aconitines which have been previously described. The formula of bikhaconitine differs from that of pseudaconitine by one atom of oxygen.

176. "**Contributions to our knowledge of the aconite alkaloids. Part XVIII. The aconitine group of alkaloids.**" By **Wyndham Rowland Dunstan and Thomas Anderson Henry.**

This paper gave a general account of the properties of the several closely allied "aconitines" which have been described in the course of the present investigation, and also of the non-poisonous alkaloids obtained from varieties of aconite. It is pointed out that now that it has been established that closely related Indian aconites furnish similar, but nevertheless quite distinct, toxic alkaloids, it is most desirable that a similar examination should be made of the European aconites of the type of *Aconitum Napellus*. The work of Wright, Jurgens, and other chemists, as well as that of the present investigators, renders it highly probable that an examination of European plants commonly classed as *Aconitum Napellus* will reveal the presence of alkaloids very closely resembling, but yet distinct from, aconitine. The evidence already recorded goes to show that the aconitine isolated by Wright from English plants and analysed by him and others, which was described in the course of the present investigation, is a distinct substance from the aconitine of German origin which is now an article of commerce.

Thursday, November 2nd, 1905, at 8.30 p.m. Professor R. Meldola, F.R.S., President, in the Chair.

Messrs. W. B. Tuck, J. W. White, and E. W. Bealey were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Adam Lawson Kelly Adam, 296, Bath Street, Glasgow.
C. Chester Ahlum, Lansdale, Pennsylvania, U.S.A.
James Edward Alcock, 42, Gill Street, Moston Lane, Blackley.
James Albert Allison, Luchana Laboratory, Apartado 45, Bilbao, Spain.
George Henry Barbrook, Stowmarket, Suffolk.

Marmaduke Barrowcliff, 25, Priory Road, Kew, Surrey.
John Coggin Brown, B.Sc., Fairleigh, Cockton Hill, Bishop Auckland.
Joseph Edward Coates, B.Sc., Sunny Side, Oakamoor, Stoke-on-Trent.
Douglas Henry Bellars Cowman, Heathville Corner, Gloucester.
Arthur Augustine Dallman, Lyndhurst, Prospect Vale, Liverpool.
John Llewelyn Davies, B.A., 8, Rugby Road, Neath.
John Doull, 8, Lauriston Place, Edinburgh.
John Beaconsfield Gall, Knoxland, Erith Road, Belvedere, Kent.
Sidney Montague Haig, St. Edmund's Ave., Port Hill, Stoke-on-Trent.
Alfred Hart, M.A., B.Sc., Norman Avenue, Hawksburn, Victoria, N.S.W.
Jack Vernon Johnson Hayman, Tringhurst, Cranleigh, Surrey.
John Michael Higgins, 39, Queen Street, Melbourne, Australia.
William Basil Hill, Eastfield, Stockton Lane, York.
Isaac Berkwood Hobsbaum, 79, Claremont Road, Forest Gate, E.
Cecil Hollins, 34, Beamsley Road, Frizinghall, Yorks.
Maurice Brooks Jack, 66, Burma Road, Clissold Park, N.
Edward Towyn Jones, B.Sc., 17, Bloomsbury Square, W.C.
Rudolph Lyon, 400, Huddersfield Road, Halifax.
William McCleary, 61, Station Road, Pendlebury, Manchester.
Robert Drysdale MacKechnie, c/o Messrs. A. Boake, Roberts and Co., Ltd., Stratford, E.
Harry Martin, 14, Hardman Street, Liverpool.
Harry George Fletcher Micklewright, B.A., 116, St. James's Rd., Croydon.
Edalji Manekji Modi, opposite Grant Road Station, Bombay.
John Motion, Edgewater, New Jersey, U.S.A.
Henry Allen Dugdale Neville, B.Sc., 81, Revidge Road, Blackburn.
Francis Richard Penn, Highthorne Terrace, Shadwell Lane, Moortown, Leeds.
Hugh Donald Perkins, Dodwell, Bursledon, Hants.
Percy Barker Phipson, c/o J. Staples and Co., Ltd., Wellington, N.Z.
Frederick John Pooler, B.Sc., The Boys' High School, Grahamstown, Cape Colony, South Africa.
James Frederick Fothergill Rowland, B.A., 5, St. James's Pk., Croydon.
Harold Marmion Royle, 12, Barfield Villas, George Lane, S. Woodford.
Harry Nestor-Schnurmann, Corinth House, Cheltenham.
Douglas Temple Setterington, 45, Regent Road, Blackpool.
John Booty Tillott, 55, Wood Street, Westminster, S.W.
Frank Tutin, 49, The Avenue, Kew, Surrey.
George Stanley Walpole, 349, Queen's Road, Battersea Park, S.W.
John Ledger White, D.Sc., 73, Cambridge Mansions, Battersea Pk., S.W.
Gerard William Williams, B.A., P.O. Box, 21, Germiston, Transvaal, S. Africa.

The PRESIDENT referred to the loss sustained by the Society in the death of Professor P. T. Cleve, who was elected an Honorary and Foreign Member in February, 1883, and who died on June 18th, 1905; also in the death of Mr. G. B. Buckton, F.R.S., who was elected a Fellow in March, 1852.

Of the following papers, those marked * were read:

***177. "Molecular conductivity of water." By Philip Blackman.**

The molecular conductivity of water may be represented by K and calculated from the equation

$$\mu_{v_{HX}} + \mu_{v_{M_1OH}} - \mu_{v_{M_1X}} = K.$$

The value of K is dependent on (1) temperature, (2) molecular concentration, and (3) nature of the acid ($\mu_{v_{HX}}$, $\mu_{v_{M_1OH}}$, $\mu_{v_{M_1X}}$ represent respectively the molecular conductivities, measured at the same temperature and molecular concentration, v, of the acid HX, the base M_1OH, and the salt M_1X).

The conclusion is drawn that the greater the value of K the stronger is the acid (taking into consideration (1) the temperature and (2) the molecular concentration). This furnishes a method for determining the relative strengths of acids.

***178. "The stereoisomerism of substituted ammonium compounds." By Humphry Owen Jones.**

The existence of Wedekind's isomeric α- and β-phenylbenzylmethylallylammonium iodides is so difficult to reconcile with the absence of isomerism in all the other compounds of the same type that the author has examined these compounds in the hope of obtaining some information about this unique example of isomerism, and has found that the two compounds are not isomerides, but different compounds.

The β-compound dissociates partially into benzyl iodide and tertiary amine in chloroform solution, but is not transformed into the α-compound; it is also completely converted into phenyltrimethylammonium iodide when heated at 100° with methyl iodide in molecular proportions, whereas the α-compound requires twice as much methyl iodide to convert it into phenyltrimethylammonium iodide and benzyl and allyl iodides. Analysis and a comparison of properties prove conclusively that the β-compound is *phenylbenzyldimethylammonium iodide*.

The analyses of the compound previously given by Wedekind and by Hantzsch and Horn are incorrect, and the reactions described

by the last-mentioned chemists can only have been obtained with impure material.

The reaction between benzylallylaniline and methyl iodide in the cold is expressed by the equation $C_7H_7\cdot NPh\cdot C_3H_5 + 2CH_3I = NPhMe_2(C_7H_7)I + C_3H_5I$, and at 100° by the equation $C_7H_7\cdot NPh\cdot C_3H_5 + 3CH_3I = NPhMe_3I + C_3H_5I + C_7H_7I$.

At present optical activity is the only evidence of stereoisomerism of quinquevalent nitrogen compounds of the type NabcdX, and, since the search for isomerides has been so thorough, it is concluded that no isomerides can be produced by the union of tertiary amines and alkyl iodides.

The hypothesis suggested by the author (*Trans.*, 1903, **83**, 1403) to account for the non-formation of isomeric quinquevalent nitrogen derivatives from tervalent compounds is now adequate to explain all the known facts and has been further developed.

Discussion.

Mr. A. W. Harvey stated that he had prepared considerable quantities of benzylphenylmethylallylammonium iodide, and that when the compound is produced by mixing molecular quantities of carefully purified benzylmethylaniline and allyl iodide in an equal volume of mixed methyl and ethyl alcohols (1—9) no trace of Wedekind's β-compound is formed; the reaction goes quite quantitatively, and yields a clean and pure solid product.

Dr. Jones, in reply, said that the β-compound was not produced together with the α-salt when allyl and benzyl iodides were added to the corresponding tertiary amines, but only when methyl iodide was used.

In reply to a question by Dr. Lapworth, the author stated that the evidence for the replacement of allyl by methyl in benzylallylaniline by the action of methyl iodide in the cold was quite conclusive, the benzyl group being only removed on heating.

*179. "Note on the fluorides of selenium and tellurium." By Edmund Brydges Rudhall Prideaux.

The fluorides of selenium and tellurium are both gaseous substances prepared by the action of fluorine on the elements, their densities corresponding to the formulæ SeF_6 and TeF_6 respectively. They are easily condensable by cold alone, forming white, snow-like solids, the vapour pressure curves of which will be published shortly along with an account of the other properties of the gases.

Discussion.

Mr. Bliss asked whether the author could give any further information as to the nature of the solid fluorides isolated by Moissan.

Mr. Prideaux, in reply, said that the solid fluoride of tellurium left in the reaction tube may be the tetrafluoride, TeF_4, described as being obtained by the action of hydrogen fluoride on tellurous acid, but is more probably an oxyfluoride.

***180. "The constitution of glutaconic acid." By Jocelyn Field Thorpe.**

The "double bond" in glutaconic acid, $CO_2H{\cdot}CH_2{\cdot}CH{:}CH{\cdot}CO_2H$, is apparently not fixed, since the reactions of this substance clearly indicate that it possesses a symmetrical structure.

Thus $\alpha\beta$-dimethylglutaconic and $\beta\gamma$-dimethylglutaconic acids, prepared by methods which leave no doubt as to their constitution, are not isomeric but identical. α-Methyl-β-ethylglutaconic acid and β-methyl-γ-ethylglutaconic acid are also identical.

Derivatives of glutaconic acid are produced when ethyl cyanoacetate or its monoalkyl derivatives react with ethyl acetoacetate or its monoalkyl derivatives, the ethyl salts formed yielding either (1) derivatives of glutaconic acid or (2) derivatives of 2 : 6-dioxypyridine, according to the nature of the hydrolysing agent and the constitution of the salt.

***181. "Some alkyl derivatives of glutaconic acid and of 2 : 6-dioxypyridine." By Harold Rogerson and Jocelyn Field Thorpe.**

Methods for the preparation of all the methyl derivatives of glutaconic acid are described, as well as the modes of preparation and properties of the corresponding derivatives of 2 : 6-dioxypyridine.

***182. "Note on the formation of β-methylglutaconic acid and of $\alpha\beta$-dimethylglutaconic acid." By Francis Vernon Darbishire and Jocelyn Field Thorpe.**

By the elimination of hydrogen bromide from ethyl α-bromo-β-methylglutarate a mixture is obtained from which β-methylglutaconic acid can be isolated, the residue consisting of the lactone ethyl salt and the corresponding acid of the trimethylene ring.

From ethyl α-bromo-$\alpha\beta$-dimethylglutarate, similar products are formed, only in this case a much larger quantity of the glutaconic acid ($\alpha\beta$-dimethylglutaconic acid) can be obtained.

***183. "The influence of water and alcohols on the boiling point of esters. I. A modification of Markownikoff's method of preparation." By John Wade.**

Ethyl acetate forms binary and ternary mixtures of minimum boiling point with ethyl alcohol and water. The ternary mixture, which contains 9 per cent. of alcohol and 8 per cent. of water, boils constantly at 70·3°, whilst the binary mixtures, which contain respectively 8·6 per cent. of water and 30·6 per cent. of alcohol, boil constantly at 70·5° and 71·8°. Most esters form such mixtures with their constituent alcohols and water, and in preparing esters from acids and alcohols by Markownikoff's method of continuous distillation in presence of sulphuric acid (*Ber.*, 1873, **6**, 1177), ternary mixtures are therefore usually obtained.

As the Markownikoff interaction, unlike the etherification process on which it is based, now proves on investigation to proceed in most cases readily at 100°, and in presence of any strong acid, it may be modified to afford a general and practically automatic method of preparing these ternary mixtures and their constituent esters in quantity. The lower alkyl esters of formic, acetic, propionic, and butyric acids have been made in this way under ordinary pressure, and various less volatile esters at the same temperature under somewhat reduced pressure. Owing to the peculiar relation of the binary to the ternary mixtures the excess of alcohol may often be removed from these products by distillation with water and fractionation.

***184. "Note on bromine fluoride." By Edmund Brydges Rudhall Prideaux.**

Fluorine when passed over bromine combines with it, as stated by Moissan, who has described the appearance of the reaction ("Le Fluor et Ses Composés"). The product, which is more unstable than iodine fluoride and decomposes water with great violence, has not been described. It is a pale yellow liquid with a specific gravity less than that of bromine, and freezes to a white solid which melts at −2°. The analysis of this fluoride leads to the formula BrF_3, and this compound appears to be the only definite fluoride of bromine.

185. "Solution and pseudo-solution. Part IV." By Ernest Linder and Harold Picton.

The authors have completed, so far as they are able, the study of solution and pseudo-solution originated by them in 1892 (*Trans.*, **61**, 114—148). The results are arranged in three sections.

Section I. The Physical and Chemical Properties of Colloidal Arsenious Sulphide.—The precipitates, which separate when arsenious sulphide is coagulated by metallic salts, are regarded as metallic derivatives of a complex hydrosulphide formed by interchange of hydrogen for metal. Thus,

$$x\mathrm{As_2S_3,H_2S} + \mathrm{BaCl_2} = x\mathrm{As_2S_3,BaS} + 2\mathrm{HCl}.$$

The coagulation process for salts of uni-, bi-, and ter-valent metals is reviewed in the light of this hypothesis. Quadrivalent metals, such as platinum and zirconium, are found to be non-coagulants of arsenious sulphide in dilute solution.

The aggregation and de-aggregation phenomena of arsenious sulphide have been studied microscopically.

Section II. The Physical and Chemical Properties of Colloidal Ferric Hydroxide.—Various "grades" of colloidal ferric hydroxide have been prepared by dialysis. The physical and chemical properties of certain of these solutions and the coagulation phenomena of the colloidal hydroxychloride have been studied by methods similar to those applied in the investigation on arsenious sulphide.

Section III. Dyeing, a Phase of Coagulation.—The "substantive dyeing" of colloidal ferric hydroxide and arsenious sulphide by methyl-violet and aniline-blue is shown to exhibit phenomena which are precisely analogous to those occurring when these colloids are coagulated by metallic salts.

186. "The influence of very strong electromagnetic fields on the spark spectra of ruthenium, rhodium, and palladium." By John Edward Purvis.

The experiments were made with a 21-foot concave grating spectroscope. The spark passed between electrodes of the metals which were firmly held between the poles of a magnet. The strength of the field between the poles of the magnet was 40,000 units with a current of 21 amperes. The nature of the vibrations was analysed by a calcite prism. The general results showed that (1) most of the lines are divided into triplets, and that there is a periodic or rhythmic change in the directions of the vibrations of the constituents of the triplets. (2) Some lines become quadruplets, and within certain definite regions of the spectrum their constituents also change the directions of their vibrations. (3) Other lines become doublets. (Only a very few lines are not affected when vibrating in the magnetic field.) (4) The inner member of the triplets is usually the strongest; but this is not always the case. The two outer members of a triplet may be stronger than the inner one; and all three are sometimes equally strong.

(5) The strongest spectral lines are not the most widely separated when vibrating in the field. Weak lines are usually more widely separated than strong ones. (6) The decrease in the width of the triplets does not proceed *pari passu* from the less refrangible to the more refrangible end of the spectrum.

187. "A volumetric method of estimating the cinchona alkaloids by means of their double thiocyanates." By Philip Wilfred Robertson.

Skey has pointed out that many alkaloids give precipitates with ammonium thiocyanate in the presence of a zinc or mercury salt. Many other metals act in a similar manner; zinc, however, forms the most insoluble precipitates. The alkaloids most sensitive to this reaction are quinine and the cinchona alkaloids. Thus in the presence of excess of zinc sulphate and ammonium thiocyanate, one part of quinine gives a distinct turbidity in 50,000 parts of water.

These precipitates prove to be double salts of considerable complexity, as is the case with the compounds of many alkaloids, more especially quinine and its allies.

Thus cinchonine ammonium zinc thiocyanate has the following composition: $4C_{19}H_{22}ON_2,3Zn(CNS)_2,2NH_4CNS,4HCNS$.

This formula corresponds closely with that of herapathite or iodoquinine sulphate, $4C_{20}H_{24}O_2N_2,3H_2SO_4,2HI,4I_2,3Aq$.

Notwithstanding the complexity of these double salts, the determination of the amount of thiocyanate removed from solution by the alkaloids forms an accurate and speedy volumetric method of estimating quinine in the commercial drugs and in the assay of the crude cinchona bark.

188. "The osmotic pressure of sugar solutions in mixtures of alcohol and water." By Percival Smith Barlow.

Some experiments have been made with copper ferrocyanide membranes and solutions of sugar in a mixed solvent of alcohol and water, which confirmed Tammann's observation that an osmotic current cannot be obtained with these membranes and alcohol. The author's experiments were spread over a considerable time, in some cases months being allowed to elapse, so that every opportunity might be afforded for the pressure to show itself. For membranes permeable to water only, the van't Hoff value of the osmotic pressure is very much diminished by the presence of the alcohol, but no idea has been obtained as yet of any relation between the amounts of alcohol present and the amount of the reduction in the pressures; below a certain strength of sugar solution there is no direct evidence of osmotic pressure, the alcohol present quite overshadowing the effect of the

sugar. There are indications that the membrane is rendered permeable to the sugar by the presence of alcohol. For a membrane permeable to the alcohol only, the pressure set up is very much less than above, and is produced extremely slowly. Whatever molecular aggregates are formed in connection with the sugar, it seems that the alcohol molecules take much less part in them than the water molecules.

ADDITIONS TO THE LIBRARY

I. *Donations.*

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Baly, E. C. C. Spectroscopy. ill. pp. xi + 568. London 1905. (*Recd.* 11/7/05.)

III. *Pamphlets.*

Becker, George F., and Day, Arthur L. An interesting pseudo-solid. (From the *Proc. Washington Acad. of Sci.*, **7**, 1905.)

—— The linear force of growing crystals. (From the *Proc. Washington Acad. of Sci.*, **7**, 1905.)

Clarke, F. W. On basic substitutions in the zeolites. (From the *Proc. Washington Acad. of Sci.*, **7**, 1905.)

Corlette, Cyril E. A review of the subject of starch digestion in young infants. (From the *Australasian Medical Gazette*, **24**, 1905.)

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Gebhardt, A. Über den Dampfdruck von Quecksilber und Natrium. (From the *Verhandl. d. Phys. Ges.*, **7**, 1905.)

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Hirt, W. B., and Steel, F. W. A rapid volumetric method for the determination of phosphoric acid. (From the *Proc. Soc. Chem. Ind. Victoria*, May, 1905.)

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Wiedemann, E. Über Dampfdrucke, besonders solche von festen

Körpern, nach Untersuchungen von K. Stelzner und G. Niederschulte. (From the *Verhandl. d. Phys. Ges.*, **7**, 1905.)

Yorkshire Geological and Polytechnic Society. The underground waters of North-West Yorkshire. Part II. The underground waters of Ingleborough. (From the *Proc. Yorks. Geol. and Polytech. Soc.*, **15**, 1904.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, December 11th, 1905.

At the next Ordinary Meeting, on **Thursday**, November **16**th, 1905, at **8.30** p.m., the following papers will be communicated:

"Silicon researches. Part IX. Bromination of silicophenyl imide and amide, and formation of a compound including the group (SiN)." By J. E. Reynolds.

"Condensation of ketones with mercury cyanide." By J. E. Marsh and R. de J. F. Struthers.

"Application of the microscopic method of molecular weight determination to solvents of high boiling point." By G. Barger and A. J. Ewins.

"Green compounds of cobalt produced by oxidising agents." By R. G. Durrant.

"Synthesis of tertiary menthol and of inactive menthene." By W. H. Perkin, jun.

"Optically active reduced naphthoic acids. Part I. Dextro-$\Delta^{(2 \text{ or } 3)}$-dihydro-1-naphthoic acid." By R. H. Pickard and A. Neville.

R. CLAY AND SONS, LIMITED, BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

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Thursday, November 16th, 1905, at 8.30 p.m. Professor R. MELDOLA, F.R.S., President, in the Chair.

Dr. Julien Drugman was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

William Edward Bell, 88, Monks Road, Lincoln.
Thomas Harold Durrans, 1, Cornwall Terrace, Regent's Park, N.W.
Walter Hamis Glover, Ph.D., 38, Ribblesdale Road, Streatham, S.W.
William Prince Hayworth, 119, Clapton Common, London, N.E.
John Kirby Shrimpton, 22, Fountains Terrace, North Road, Ripon.
Franklin Wilfred Walker, 39, Graham Road, Acton Green, W.
Richard Alfred Warren, Belle Vue, Hallow Road, Worcester.
Harold Joseph Wheaton, 21, Chesterton Road, Cambridge.
Herbert William Mills Willett, The Cedars, Chislehurst.
Ernest Edwin Wolfe, Kinsale, Co. Cork, Ireland.

Certificates were authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of Messrs.:

Charles Anthony, jun., Town Hall, East London, Cape Colony.
John Dunlop Millen, Launceston, Tasmania.
Henry Rowley, Perth, Western Australia.

Of the following papers, those marked * were read :

***189. "Condensation of ketones with mercury cyanide."**
By James Ernest Marsh and Robert de Jersey Fleming-Struthers.

Acetone added to a solution of mercury cyanide in aqueous caustic soda gives a white precipitate, $Hg_3C_5H_2ON_2$, insoluble in water or alcohol, which dissolves on further addition of acetone. The best yield is obtained with one molecule of acetone to not less than fifteen molecules of mercury cyanide. No precipitate at all is formed with one molecule of acetone to less than two molecules of mercury cyanide. The reaction forms a good test for acetone applicable also in presence of alcohol. The following formula represents the probable constitution of the compound : $Hg\begin{cases}CH\cdot HgCN\\ CO\\ CH\cdot HgCN\end{cases}$. The same substance is formed by adding acetone to a solution of mercury cyanide and sodium ethoxide in alcohol, or sodium methoxide in methyl alcohol. The compound, which is decomposed by hydrochloric acid with liberation of acetone and hydrogen cyanide, is also decomposed by aqueous potassium cyanide with liberation of acetone. Strong sulphuric acid attacks it slowly, forming a soluble compound which is being further investigated.

Acetophenone yields a similar compound, $Hg_4C_{26}H_{18}O_3N_2$, with mercury cyanide in aqueous caustic soda ; the constitution of this product may probably be represented by the following formula :

$$C_6H_5\cdot CO\cdot \underset{\underset{CN}{|}}{\overset{\overset{Hg}{|}}{CH}}\cdot Hg\cdot \underset{\underset{C_6H_5}{|}}{\overset{\overset{CO}{|}}{CH}}\cdot Hg\cdot \underset{\underset{CN}{|}}{\overset{\overset{Hg}{|}}{CH}}\cdot CO\cdot C_6H_5 .$$

The reactions appear to be confined to ketones containing the group $CO\cdot CH_3$; precipitates were not obtained with diethyl ketone, benzophenone, menthone, or camphor. But ethyl acetoacetate and diphenylmethyl ketone give similar compounds. Precipitates were also obtained with ethyl malonate and ethyl *iso*succinate. Aldehydes generally bring about a reduction of the mercury cyanide. Benzaldehyde and anisaldehyde give almost quantitatively their respective acids.

***190. "Silicon researches. Part IX. Bromination of silicophenylimide and -amide, and formation of a compound including the group (SiN)." By James Emerson Reynolds.**

In Part VII of this series of papers, the author showed that the fine crystalline silicophenylamide, $Si(NHC_6H_5)_4$, described in Part V, can be made to afford silicotriphenylguanidine, and, ultimately, silicodiphenylimide, $Si(NC_6H_5)_2$. The latter is isomeric with the still unknown silicocyanamide, $SiN{\cdot}N(C_6H_5)_2$. The aim of the present inquiry has been to study the action of bromine directly on the di-imide, or indirectly through the silicophenylamide, in the hope of forming a compound including the group SiN analogous to cyanogen.

The di-imide in the form of very fine powder was found to combine with two atomic proportions of bromine, even in the cold, when the halogen was present in benzene solution, the insoluble additive compound, $Si(NC_6H_5)_2Br_2$, being formed. When this substance was warmed with excess of bromine, also diluted with much benzene, the aniline residues were attacked and variable mixtures were obtained, which proved to be very difficult to separate. On the other hand, silicophenylamide, being easily soluble in benzene, was found to be much more suitable for the systematic study of the products of bromination.

One molecular proportion of silicotetraphenylamide in benzene solution interacts quite regularly with about six atomic proportions of bromine, also dissolved in benzene, provided the temperature is kept down and the addition of the halogen made very slowly. The colour of bromine disappears and a precipitate forms from the outset consisting of aniline and bromoaniline hydrobromides. It was found, however, that three successive stages can be recognised in this interaction, and each one has been closely examined.

(1) In the first stage, bromine (2 atoms) effects the removal of one of the aniline residues in the form of hydrobromide, which separates out, and there remains in solution the substituted guanidine,

$$Si\begin{cases} NH{\cdot}C_6H_5 \\ =N{\cdot}C_6H_4Br. \\ NH{\cdot}C_6H_5 \end{cases}$$

(2) At the second stage, the guanidine is attacked by a similar proportion of bromine, which causes the removal of more hydrobromide and the formation of a soluble disubstituted di-imide, $Si\begin{cases} N{\cdot}C_6H_4Br \\ N{\cdot}C_6H_4Br \end{cases}$. This substance does not appear to form another additive compound analogous to that afforded by the unsubstituted di-imide.

(3) The third stage, in which another molecule of bromine acts on the substituted di-imide, is to some extent conditioned by the dilution

of the benzene solution in which the interaction takes place; but the chief change involves the removal of a third aniline residue, leaving in solution the SiN compound $SiN{\cdot}C_6H_3Br_2$.

Under varying conditions, more or less of at least one other substance is formed, with the elimination of HBr, namely, $Si\begin{matrix}N{\cdot}C_6H_4Br\\N{\cdot}C_6H_3Br_2\end{matrix}$, and, probably, a still smaller proportion of $Si\begin{matrix}N{\cdot}C_6H_3Br_2\\N{\cdot}C_6H_3Br_2\end{matrix}$.

The nitrile, when purified as far as is at present possible, is a dark-coloured, vitreous solid fusible at about 60°. It is easily decomposed by water and alcohol, but is dissolved as a whole by pure ether, provided the temperature is not allowed to rise above 5°. At the ordinary temperature, the solution decomposes and ethyl silicates are formed, whilst a brown precipitate slowly separates, chiefly consisting of a bromoaniline derivative.

Treatment with excess of bromine leads to the production of silicon bromide and hydrogen bromide, whilst highly brominated anilines separate.

***191. "Application of the microscopic method of molecular weight determination to solvents of high boiling point." By George Barger and Arthur James Ewins.**

The method by which the vapour pressures of two solutions are compared, by measuring microscopically the change in thickness which drops of these solutions undergo when placed in a capillary tube, was originally worked out by one of the authors for use at the laboratory temperature (*Trans.*, 1904, **85**, 286). A hot stage is now described, which can readily be made, and by means of which the tubes can be kept under observation at a constant temperature (up to 95°). The capillaries are fastened to a microscope slide, which is fixed with a spring inside a glass tube, about 25 millimetres wide, through which a stream of hot water flows, thus keeping the temperature constant to within one or two degrees. This tube is provided with a thermometer and rests in a block of wood on the microscope stage.

With volatile solvents, such as alcohol and benzene, one per cent. differences in the molecular concentration of two solutions can be detected in five to ten minutes at a temperature of about 80°. With aniline, the least volatile solvent which can be conveniently employed, the corresponding time at 95° is one hour.

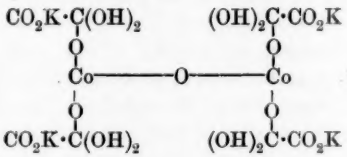
The solvent need not be pure: oil of turpentine, for example, gave satisfactory results. The time required for a complete determination is about an hour and a half; for the mere verification of a probable

formula, much less time is necessary. The average error in thirty determinations quoted is three per cent. Pyridine, acetic acid, and aniline are the best of the less volatile solvents examined.

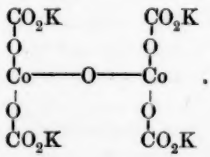
***192. "Green compounds of cobalt produced by oxidising agents." By Reginald Graham Durrant.**

Methods of obtaining green compounds by oxidising cobaltous salts in presence of the alkali salts of acetic, tartaric, citric, oxalic, lactic, malic, succinic, and glycollic acids were given. The preparation, analysis and properties of green crystalline potassium cobaltic oxalate were set forth in detail, and evidence was adduced in support of the existence of analogous crystalline ammonium cobaltic and calcium cobaltic oxalates.

The conclusions arrived at are that (1) these substances most probably all contain the nucleus $>Co\cdot O\cdot Co<$, the oxalate being



and the carbonate



(2) The prevailing green colour in these cobaltic compounds with carboxylic salts depends on the persistence of the complex Co·O·Co.

(3) The differences observable in the tints and in the absorption spectra of the various green solutions depend probably on the varied association of carboxyl groups attached to this nucleus.

***193. "Dunstan, Jowett, and Goulding's paper on the rusting of iron." By Edward Divers.**

The fact which throws into the background all others contained in the important paper by Dunstan, Jowett, and Goulding on the rusting of iron (*Trans.*, 1905, **87**, 1548), and, indeed, constitutes its substance, is that even the purest available iron is freely rusted by oxygen and liquid water, unaided by carbon dioxide or any other substance. Yet,

in the construction of the paper, this fact seems to have been subordinated, perhaps without intention, to the setting forth of, and submitting evidence for, the theory that the rusting of iron is a process involving the formation of hydrogen peroxide. Accordingly, the publication (*Proc.*, 1903, **19**, 150) of a preliminary abstract of the contents of the full paper led Moody (*loc. cit.*, p. 157) to suppose Dunstan's contention to be that ordinary rusting is caused by hydrogen peroxide. There is, therefore, reason to fear that those chemists who may hesitate to accept the hydrogen peroxide theory will be apt to overlook the fact that whether with or without the intervention of hydrogen peroxide, iron rusts when in contact with nothing more than an aqueous solution of oxygen.

Now the truth of the authors' theory to explain the fact may well be doubted, although they themselves hold that they have obtained a considerable body of experimental evidence in favour of the temporary formation of hydrogen peroxide. For, in support of the theory, no other fact is to be found in the paper than that the alkalis and other substances, which interfere with the existence of hydrogen peroxide, likewise prevent the rusting of iron. But the coincidence here observed is fully and accurately accounted for, without dependence on hydrogen peroxide, as being the result of the inability of oxygen and water in presence of one of these substances to act together as *hydroxyl*, whether it be to form hydrogen peroxide, $(HO)_2$, or such a compound as zinc hydroxide, $Zn(HO)_2$. Hydrogen peroxide is not wanted in order to explain the rusting of iron; indeed, its production stands rather in the way of a simple theory. What is wanted is the presentation of free or at least available hydroxyl groups to unite with the iron. Again, it is hardly a tenable argument that a substance, because it interferes with the existence of another substance, must likewise prevent its formation. For instance, ferrous sulphate ends the existence of free chlorine, but it does not prevent manganese dioxide and hydrochloric acid in contact with it producing the atomic chlorine, which it immediately proceeds to consume.

Moritz Traube explained and experimentally illustrated what he called the "autoxidation" of metals and other substances as being the chemical intervention of the water molecule between that of the autoxidising substance and that of the oxygen. Water, which cannot be acted on by either alone, is capable of chemical partition between the two: with zinc present to seize the hydroxyl of the water, the oxygen can take the rest of its hydrogen to form hydrogen peroxide, and, accordingly, this substance is not an uncommon product of autoxidation. It is easy and natural to admit that, with the great evolution of energy in the union of zinc with hydroxyl, only the small addition of energy afforded by the hydrogenation of free oxygen

into hydrogen peroxide should be sufficient to half dehydrogenate the oxygen of water. Traube's equation satisfactorily represents, therefore, the formation of the hydrogen peroxide. The authors, however, give equations which are indistinguishable from those suggested by Hoppe-Seyler, although they very rightly reject this physiological chemist's conception of the nature of oxidation. They write (*loc. cit.*, p. 1549) $Fe + O_2 + H_2O = FeO + H_2O_2$ [Traube would have written it $Fe + 2OH{\cdot}H + O_2 = Fe(OH)_2 + H_2O_2$]. Again, on p. 1564, they write $Fe + OH_2 = FeO + H_2$; $H_2 + O_2 = H_2O_2$, equations which have none of the acceptability of Traube's. Can it be admitted that iron may do what potassium cannot do, displace all the hydrogen of water? Can it be allowed by the laws of thermal chemistry that cold water can be endothermically oxidised into hydrogen peroxide? There is another equation, given to explain the action of hydrogen peroxide on iron, to which also exception must be taken: $Fe + H_2O_2 = FeO + H_2O$. Surely if the equation holds good at all, the right side of it should be written $Fe(OH)_2$, the hydroxyls uniting with the iron, even if, afterwards, water separates.

The conversion of iron into rust seems to be as fully explained and as simply displayed as the facts allow by the following equation: $(O_2 + 2H{\cdot}HO) + 4Fe + 2O_2 = 4HO{\cdot}Fe{:}O$, or, if preferred, $2(HO)_2Fe_2O_2$. If it is proper, as it apparently may be, to represent the ferrous and the ferric oxidation as distinct, then the above equation may be resolved into $(O_2 + 2H{\cdot}HO) + 4Fe + O_2 = 2(HO{\cdot}Fe'')_2O$ (ferrous oxyhydroxide) and $2(HOFe'')_2O + O_2 = 4HO{\cdot}Fe''O$. Putting these equations into words, rusting consists in the oxidation of iron by oxygen, with the intervention of water as hydroxyl hydride to the extent of two * molecules for every three molecules of oxygen consumed. To account for the non-formation of hydrogen peroxide nothing need be advanced; that seems to come as a matter of course. The point to be explained is, rather, the very production of this substance during the autoxidation of zinc and other substances. Why do not all the hydroxyls combine with the zinc, instead of a very small proportion of them remaining as hydrogen peroxide? The equation $Zn + 2OH{\cdot}H + O_2 + Zn = 2Zn(OH)_2$ seems to express accurately what really does happen to a very great extent.

Discussion.

The following communication from Professor Dunstan was read by the Secretary: "In the preceding note, Dr. Divers has expressed the fear that the important fact established in the paper by Drs. Jowett and Goulding, and myself, that iron will rust in an aqueous solution

* Instead of the six molecules of water required by Traube's equation in the theoretical production of $Fe_2(OH)_6$.

of oxygen without carbon dioxide, will be overlooked. This fear is, however, not justified in view of the explicit statements contained in the paper and the prominence given to the experimental evidence.

"Dr. Divers is of opinion that the intermediate formation of hydrogen peroxide, suggested as a working hypothesis to account for the observed facts, is unnecessary, but the alternative view expressed by him as 'the presentation of available or free hydroxyl groups to unite with iron' is not intelligible, unless it amounts to what is virtually the same hypothesis, which accounts for the inhibiting effect of potassium dichromate as well as of alkalis.

"With regard to the mechanism of the change, it has not been suggested, as Dr. Divers supposes, that water is oxidised to hydrogen peroxide. On the contrary, Traube's view of the formation of hydrogen peroxide is accepted. The outline equations in the paper (*Trans.*, 1905, **87**, 1548) were not intended to do more than represent the general nature of the change, and may equally well be written to show that the metal takes the hydroxyl and not strictly the oxygen of the water. There is no exception to be taken to the condensed equations Dr. Divers gives in conclusion, but unless the intermediate formation of hydrogen peroxide is assumed, they do not explain the inhibiting effect of alkalis or of other salts. There is no evidence to show that alkalis interfere with the formation of simple hydroxides such as $Zn(OH)_2$.

"Dr. Divers fails to offer any satisfactory explanation of the undoubted formation of hydrogen peroxide during the 'rusting' of zinc, where the process at work must be strictly analogous to that which occurs in the case of iron."

Mr. A. C. Chapman said that it was rather surprising that investigators who had studied the rusting of iron and the action of water on other metals in the presence of oxygen should have apparently devoted so little attention to the influence of traces of metallic impurities in the metals under observation. Such changes were, of course, electrolytic in nature, and it seemed to him very probable that in many cases the action would be very greatly modified if metals of a very high degree of purity could be used in the experiments. Dr. Divers had referred to the combined action of oxygen and water on metallic zinc, and he had recently had occasion to observe how very greatly this was affected by the presence of very slight traces of nickel, cobalt, or other metallic impurities in the zinc employed.

In reply, Dr. Divers referred Professor Dunstan and also Dr. Jowett to his foregoing note, in which it is explained that the inhibitory action of such a substance as potassium hydroxide or dichromate is fully accounted for as being due to its making oxygen and water unable to behave either as hydroxyl towards iron or as

hydroxyl for becoming hydrogen peroxide. He thought with Mr. Chapman that even the purest zinc yet used may have been active upon air and water through electrolysis by means of some impurity.

He was aware that the authors had treated iron as being acted on by hydrogen peroxide, but all that he had wished to contend against had been their assumption that air and water owe their activity to a production of hydrogen peroxide. Dr. Moody had fully shown that hydrogen peroxide in pure water is inactive upon iron.

***194. "Researches on the freezing points of binary mixtures of organic substances: the behaviour of the dihydric phenols towards *p*-toluidine, α-naphthylamine, and picric acid." By James Charles Philip and Sydney Herbert Smith.**

Investigation of the freezing-point curves demonstrates the existence of several new compounds of the above substances. As might have been expected, it was found that catechol and resorcinol were able in certain cases to form two compounds with a base: for example, catechol forms two compounds with *p*-toluidine containing the constituents in the molecular ratio of 1 : 1 and 1 : 2 respectively, and freezing at 50·4° and 41·5°. Since the 50 molecular per cent. compound crystallises sluggishly, it is possible to realise metastable freezing points on the adjacent branches of the curve. In this respect, the 50 per cent. compound is similar to $Fe_2Cl_6,7H_2O$ in Roozeboom's curve for the hydrates of Fe_2Cl_6. Resorcinol and *p*-toluidine were also found to combine in two proportions.

Quinol does not form compounds so readily as resorcinol and catechol, and in the case of quinol and α-naphthylamine only a slight indication of the formation of a compound is obtained in the form of an intermediate branch of the curve which does not reach a summit.

The picrates of catechol and resorcinol, as shown by the freezing-point curves, are well-defined compounds containing a molecule of each constituent. The freezing point of catechol picrate is higher than the freezing point of either component.

195. "Synthesis of tertiary menthol and of inactive menthene." By William Henry Perkin, jun.

When hexahydro-*p*-toluic acid is treated with phosphorus pentachloride and bromine, it is converted into α-bromohexahydro-*p*-toluic acid (Perkin and Pickles, *Trans.*, 1905, **87**, 645), which melts at 109—110° and is hydrolysed by dilute sodium carbonate with formation of α-hydroxyhexahydro-*p*-toluic acid (m. p. 132°) and Δ^1-tetrahydro-*p*-toluic acid. The hydroxy-acid is readily decomposed by sulphuric acid

with elimination of carbon monoxide, and the solution, on dilution with water, yields 1 : 4-methyl*cyclo*hexanone (b. p. 170°):

$$CHMe\langle\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\rangle C(OH)\cdot CO_2H \text{ yields } CHMe\langle\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\rangle CO,$$

considerable quantities of Δ^1-tetrahydro-*p*-toluic acid being produced at the same time. 1 : 4-Methyl*cyclo*hexanone reacts readily with magnesium *iso*propyl iodide and is converted into *tertiary menthol*,

$$CHMe\langle\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\rangle C(OH)\cdot C_3H_7,$$

which distils at 95° under 25 mm. pressure (compare Baeyer, *Ber.*, 1893, **26**, 2270), and when digested with potassium hydrogen sulphate yields *inactive menthene*, $CHMe\langle\begin{matrix}CH_2\text{---}CH\\CH_2\cdot CH_2\end{matrix}\rangle C\cdot C_3H_7$.

This synthetical hydrocarbon distilled at 168° and yielded the characteristic *nitrosochloride* melting at 128°; there can therefore be no doubt that it is the inactive modification of menthene (compare Urban and Kremers, *Amer. Chem. J.*, 1894, **16**, 395).

196. "The synthetical formation of bridged rings. Part II. Some derivatives of di*cyclo*butane." By William Henry Perkin, jun., and John Lionel Simonsen.

When the sodium derivative of ethyl malonate (1 mol.) is digested with tribromopropane, $CH_2Br\cdot CHBr\cdot CH_2Br$, an ester of the formula $C_{10}H_{15}O_4Br$ is obtained, which distils at 154° (26 mm.) and evidently has the constitution $CH_2Br\cdot\underset{|}{CH}\rangle\overset{CH_2}{\vphantom{CH}}C(CO_2Et)_2$. Alcoholic potash decomposes this ester with formation of a crystalline acid, $C_4H_4(CO_2H)_2$, which melts at 139°, is only slowly oxidised by permanganate, and does not decolorise a solution of bromine in chloroform; it is not reduced when its solution in sodium carbonate is boiled with a large excess of sodium amalgam, and, when treated with hydrobromic acid, it is converted into a hydroxy-acid, $C_4H_5(OH)(CO_2H)_2$, which melts at 150°.

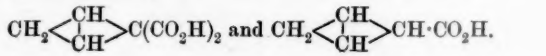
It is readily esterified by alcohol and sulphuric acid, yielding an ester, $C_4H_4(CO_2Et)_2$, which distils at 129° (22 mm.).

When the acid $C_4H_4(CO_2H)_2$ is heated, it loses carbon dioxide with formation of the corresponding monobasic acid, $C_4H_5\cdot CO_2H$, which melts at 57° and yields an ester, $C_4H_5\cdot CO_2Et$, which distils at 160—161° (765 mm.).

The monobasic acid is not reduced when its alkaline solution is boiled with excess of sodium amalgam; it does not decolorise bromine, and when treated with hydrobromic acid or hydriodic acid it yields a

dihydrobromide, $C_4H_7Br_2 \cdot CO_2H$ (m. p. 53°), and a *dihydriodide*, $C_4H_7I_2 \cdot CO_2H$ (m. p. 90°), respectively.

These and other properties seem to prove that the acids $C_4H_4(CO_2H)_2$ and $C_4H_5 \cdot CO_2H$ are *dicyclobutane* derivatives, having respectively the formulæ



197. "Optically active reduced naphthoic acids. Part I. Dextro-$\Delta^{2\,(or\ 3)}$-dihydro-1-naphthoic acid." By Robert Howson Pickard and Allen Neville.

dextro-$\Delta^{2(or\ 3)}$-*Dihydro*-1-*naphthoic acid* is obtained from the *l*-menthylamine salt, which is less soluble in ethyl acetate than the corresponding salt of the lævo-acid; it has $[M]_D$ +370·4° in chloroform. The transformation of the $\Delta^{2(or\ 3)}$-acid into the Δ^1-acid in the presence of sodium hydroxide proceeds as a unimolecular reaction.

198. "Hydrizino-halides derived from oxalic acid." By Douglas Anderson Bowack and Arthur Lapworth.

All the azo-derivatives of ethyl acetoacetate which have been examined by the authors are converted, on treatment with bromine or chlorine, into hydrizino-halides * having the general formula $Cl[or\ Br] \cdot C(CO_2C_2H_5){:}N \cdot NHX$ (compare *Trans.*, 1903, **83**, 1114).

The halogen atom in these compounds is very difficult to remove except in alkaline solution. With aqueous ammonia, the halogen is replaced by amidogen, whilst prolonged action of the agent leads to the further replacement of the ethoxyl group; the resulting compounds, $NH_2 \cdot C(CO_2 \cdot C_2H_5){:}N \cdot NHX$ and $NH_2 \cdot C(CO \cdot NH_2){:}N \cdot NHX$, are yellow and feebly basic in character. The members of the former class may be converted into the corresponding carboxylic acids, which lose carbon dioxide when heated.

Solutions of the hydroxides or carbonates of the alkali metals act very rapidly on the hydrizino-halides, and condensation products which are probably dihydrotetrazine derivatives, for example, $CO_2Et \cdot C\begin{matrix}N \cdot NX\\ NX \cdot N\end{matrix}C \cdot CO_2Et$, are obtained. These compounds form deep red crystals with a blue reflex.

* The term "hydrizino-" used for compounds containing the group $-NH \cdot N=$ corresponds with "imino," which refers to those including the radicle $-N$.

199. "The action of nitrogen sulphide on organic substances. Part III." By Oliver Charles Minty Davis.

The investigation of the action of nitrogen sulphide on the aldehydes has been continued, and it has been found that the reaction is not so general as was expected. Cinnamaldehyde, salicylaldehyde, and cuminaldehyde do not react to any extent, and the yields in other cases are very small. The nitrobenzaldehydes experimented with give the corresponding cyanidine derivatives, and an interesting example of steric hindrance is illustrated in the case of *o*-chlorobenzaldehyde, which is not appreciably decomposed, whereas the 1 : 4-compound readily yields the cyanidine derivative. A similar instance is noticed in the case of *o*-methoxybenzaldehyde, which furnishes a small amount of the cyanidine derivative, the 1 : 4-compound previously experimented with (*Trans.*, 1904, **85**, 1535) giving a good yield of the cyanidine, in addition to a sulphur compound and an anisamidine sulphate. Piperonaldehyde, on the other hand, in which the ortho-position with respect to the aldehyde grouping is unsubstituted, behaves in an analogous manner to anisaldehyde.

200. "The action of nitrogen sulphide on organic substances. Part IV." By Francis Ernest Francis.

Nitrogen sulphide acts on acetic and propionic acids at their boiling points with the liberation of sulphur dioxide and smaller quantities of nitrogen and the formation of the corresponding amides and diamides; in both cases ammonium sulphate and free sulphur are also formed.

The action on acetic anhydride and the halogen derivatives of acetic acid is very similar. Chloro- and bromo-acetic acids give mixtures of their corresponding amides and diamides, di- and tri-chloroacetic acids only giving rise to di- and tri-chloroacetamides respectively.

That a deep-seated decomposition of the molecule takes place in these reactions is shown by the liberation of notable quantities of carbon monoxide, together with the other gases mentioned, and, further, the formation, in varying quantity, of the ammonium haloid salt corresponding with the halogen derivative employed.

201. "Tetrazoline. Part III." By Siegfried Ruhemann and Richard William Merriman.

The authors, who have undertaken this research with the view of investigating the remarkable properties of tetrazoline, and more especially of determining the constitutions of the two compounds which this base forms with methyl iodide (Ruhemann and Stapleton, *Trans.*,

1902, **81**, 261), have found that the colourless substance $C_3H_7N_4I$ combines with iodine to yield the blue additive product identical with the compound which is produced along with $C_3H_7N_4I$ by the action of methyl iodide on tetrazoline. It therefore has the composition $C_3H_7N_4I_3$ instead of $C_3H_9N_4I_3$, as previously stated. The resemblance of this additive product to the periodide of diazobenzene chloride led the authors to the view that $C_3H_7N_4I$ has the constitution $HN<\begin{matrix}CH_2\cdot N\\ N=CH\end{matrix}>N(CH_3I)$, and therefore $C_3H_7N_4I_3$ the analogous formula $HN<\begin{matrix}CH_2\cdot NI\\ N=CH\end{matrix}>NI(CH_3I)$. It would therefore follow that the action of methyl iodide on tetrazoline, $NH<\begin{matrix}CH:N\\ N:CH\end{matrix}>NH$, causes an isomerisation to $NH<\begin{matrix}CH_2\cdot N\\ N:CH\end{matrix}>N$. Such a transformation, as shown, takes place readily by the action of aldehydes on tetrazoline in the presence of piperidine, when compounds of the general formula $NH<\begin{matrix}C(:CHR)\cdot N\\ N=\!=\!=CH\end{matrix}>N$ are formed.

The authors have thus prepared a large number of condensation products, and have found that, although partially hydrolysed by hydrochloric acid, these solutions yield normal platinichlorides. The hydrolysis is complete on boiling with the dilute acid, and tetrazoline is formed together with aldehydes. The authors arrive at the conclusion that the hydrochloride of this base exists in two tautomeric forms, $NH<\begin{matrix}CH:N\\ N:CH\end{matrix}>NH,HCl$ and $HN<\begin{matrix}CH_2\cdot N\\ N=CH\end{matrix}>N,HCl$, which are interchangeable. Platinic chloride is used as a means of recognising them, since the one modification forms the canary-yellow additive product, $(C_2H_4N_4)_2,PtCl_4$, previously described, whilst the other yields the orange normal platinichloride, $(C_2H_4N_4)_2,H_2PtCl_6$.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

British Museum. Mineral Department. An introduction to the study of meteorites. With a list of the meteorites represented in the collection of January 1st, 1904. By L. Fletcher. pp. 109. London 1904. (*Recd.* 12/11/05.) From the Trustees.

Bronn, J. Verflüssigtes Ammoniak als Lösungsmittel. Materialien

über die chemischen Eigenschaften des verflüssigten Ammoniakgases. pp. 252. Berlin 1905. (*Recd.* 2/11/05.)

From Bennett H. Brough, Esq.

De l'Arbousset, Laurent. On silk and the silkworm. A practical treatise on sericulture. Translated by Elizabeth Wardle, and edited by her father, Sir Thomas Wardle. pp. viii + 287. ill. Leek 1905. (*Recd.* 12/8/05.) From Sir Thomas Wardle.

Foster, Sir Clement Le Neve. A treatise on ore and stone mining. Sixth edition, revised and enlarged by Bennett H. Brough. pp. xxx + 799. ill. London 1905. (*Recd.* 2/11/05.)

From Bennett H. Brough, Esq.

Hall, A. D. The book of the Rothamsted Experiments. pp. xl + 294. ill. London 1905. (*Recd.* 14/11/05.)

From the Author.

Handbuch der anorganischen Chemie. Herausgegeben von R. Abegg. Band II. Abteilung 2. pp. ix + 700. Leipzig 1905. (*Reference.*)

From the Publisher.

Institution of Mechanical Engineers. Sixth report to the Alloys Research Committee: on the heat treatment of steel. By the late Sir William C. Roberts-Austen, K.C.B., completed by Professor William Gowland. pp. 174. ill. London 1904. (*Recd.* 25/10/05.)

From Professor W. Gowland.

Morgan, J. Livingston Rutgers. The elements of physical chemistry. Third edition. pp. xii + 510. New York 1905. (*Recd.* 7/11/05.) From the Publishers.

Wade, John. Introduction to the study of organic chemistry. pp. xx + 646. ill. London 1905. (*Recd.* 16/11/05.)

From the Author.

Wells, Horace L. A text-book of chemical arithmetic. pp. 169. New York 1905. (*Recd.* 7/11/05.) From the Publishers.

II. *By Purchase.*

Jahn, Hans. Grundriss der Elektrochemie. Zweite Auflage. pp. xii + 549. Wien 1905. (*Recd.* 15/11/05.)

Senft, Emanuel. Mikroskopische Untersuchung des Wassers mit Bezug auf die in Abwässern und Schmutzwässern vorkommenden Mikroorganismen und Verunreinigungen. pp. viii + 196. ill. Wien 1905. (*Recd.* 15/11/05.)

RESEARCH FUND

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, December 11th, 1905.

At the next Ordinary Meeting, on **Thursday**, December **7th**, 1905, at **8.30** p.m., there will be a ballot for the election of Fellows and the following papers will be communicated :

"The constitution of nitrites. Part I. Two varieties of silver nitrite." By P. C. Rây and A. C. Gañguli.

"The products of heating silver nitrite." By E. Divers.

"Ethyl piperonylacetate." By W. H. Perkin, jun., and R. Robinson.

"A contribution to the chemistry of saccharin." By F. D. Chattaway.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, December 7th, 1905.

Adam, Adam Lawson Kelly,
296, Bath Street, Glasgow.

Analytical Chemist. I was for eight years Assistant in the Laboratory of Messrs. R. R. Tatlock & Thomson, Public Analysts, Glasgow, and for one year Teacher in the Students' Department of the same firm. I am now Research Chemist to Messrs. McCaw, Stevenson & Orr, Ltd., Linenhall Works, Belfast.

R. R. Tatlock. James McLeod.
R. T. Thomson. *J. Falconer King.*
Thomas Gray. *John Clark.*

Ahlum, C. Chester,
Lansdale, Pennsylvania, U.S.A.

Chemist for Geo. W. Lord Co., Phila., Chemist and Bacteriologist for Lansdale Board of Health. Member of the American Chemical Society and the Franklin Institute. Vice-pres. of the Lansdale Scientific Association. Have contributed papers to both the American Chemical Society and the Franklin Institute, and have given a number of lectures before the Lansdale Scientific Association.

(The papers are upon improved methods of analysis).

Ernest A. Congdon. Samuel C. Hooker.
Charles Platt. *J. Livingston R. Morgan.*
Clifford Richardson.

Alcock, James Edward,

42, Gill Street, Moston Lane, Blackley.

Chemist. Has been a student in the evening classes of the Chemical Department of the School of Technology, Manchester, for eight years, more especially in Chemical Technology. Engaged in Chemical Works for fourteen years, and for the last four years has held a responsible position. Wish to join the Society so as to be in closer touch with the subject and to obtain the Journal.

W. J. Pope. F. S. Sinnatt.
Jas. Grant. Stanley J. Peachey.
L. G. Radcliffe. *F. G. Richards.*

Allison, James Albert,

Luchana Laboratory, Apartado 45, Bilbao, Spain.

Analytical Chemist. Learnt Analytical Chemistry under Messrs. Pattinson and Stead, Middlesbro', and have had an experience of 24 years in the analysis of all kinds of minerals, &c. For 13 years as Chief Chemist at Darlington Steel Works, and afterwards at Bilbao, where all classes of minerals have to be constantly analysed.

Frank B. Last. H. Percy Lewis.
Jas. D. Dougall. *R. R. Tatlock.*
R. T. Thomson.

Barbrook, George Henry,

Stowmarket, Suffolk.

Analytical Chemist and Malting and Brewing Chemist for Thomas Prentice & Co., Stowmarket. I am desirous of keeping up with current literature.

John Heron. Otto Hehner.
Arthur R. Ling. *L. T. Thorne.*
Alfd. C. Chapman.

Barrowcliff, Marmaduke,

25, Priory Road, Kew, Surrey.

Research Chemist in the Wellcome Chemical Research Laboratories. Associate of the Institute of Chemistry. Five years' study of chemistry at Univ. Coll., Nottingham. Joint author of papers published in the Journal of the Chemical Society.

Frederick B. Power. R. M. Caven.
F. S. Kipping. H. A. D. Jowett,
A. C. O. Hann.

Brown, John Coggin,

Calcutta. (Home address) Fairleigh, Cockton Hill, Bishop Auckland.

Assistant Superintendent H.M. Geological Survey of India. Final B.Sc., Durham. Honours in Chemistry. Johnston Scholar in Chemistry and Mineralogy. Late Lecturer Assistant, Chemical Dept., Armstrong College, Newcastle-on-Tyne. Awarded Freire Marrew Medal and Prize for work on "Molybdenum." Saville Shaw Medal for work on "Uranium" by the Newcastle Sect. of the Soc. of Chem. Industry. Papers: "A Note on Molybdenum" (*Univ. Dur. Phil. Soc. Trans.*, June, 1905). "The Preparation of Some Compounds of Uranium from Pitchblende."

P. Phillips Bedson. S. Hoare Collins.
F. C. Garrett. Roger Dodds.

J. T. Dunn.

Burt, Bryce Chudleigh,

Port of Spain, Trinidad, B.W.I.

Assistant Analyst and Science Master to Government of Trinidad. Bachelor of Science, 1st Class Honours, Lond., 1901. University demonstrator and assistant lecturer, Liverpool, 1902–4. Published "The Solubilities of Lithium Nitrate and its Hydrates" (*Trans.*, 1903). "The Vapour Pressures of Sulphuric Acid" (*Proc.*, 1903, *Trans.*, 1904).

P. Carmody. F. G. Donnan.
J. Campbell Brown. A. W. Titherley.
W. Collingwood Williams.

Coates, Joseph Edward,

Sunnyside, Oakamoor, Stoke-on-Trent.

Scientific Chemist. B.Sc. (Wales), with First Class Honours in Chemistry. Osborn Morgan Student of University College, Bangor. Fellow of the University of Wales. Conjoint author of a paper on "Diazo-compounds" (*Proc. Chem. Soc.*, Vol. 21, No. 296).

Kennedy J. P. Orton. James J. Dobbie.
Allan Baguley. Alexander Lauder.
Robt. D. Abell.

Cowman, Douglas Henry Bellars,

Heathville Corner, Gloucester.

Chemistry Master, the Grammar School, Clonmel. Five years articled pupil and assistant to G. Embrey, F.C.S., F.I.C., Public

Analyst for Gloucester, &c. Assistant Chemist to Cotton Seed Co., Cubitt Town, E. Assistant chemist to United Asbestos Co.

George Embrey. J. M. Collett.
J. Holms Pollok. J. S. S. Brame.
C. R. Gardner.

Dallman, Arthur Augustine,

Lyndhurst, Prospect Vale, Liverpool.

Science Teacher. Student at Harris Institute, Preston, 1896—1901. Demonstrator and Assist. Lecturer in Chemistry, Liverpool College, 1901—1903. Lecturer in Chemistry, Port Sunlight Technical Institute, 1903. Demonstrator in Physical Chemistry and Physics, Liverpool College, 1903—1904. Science Master at Bebington College, Cheshire, from 1904.

Arthur J. Cooper. Lawrence Caldecott.
John B. Coppock. *Prosper H. Marsden.*
M. C. Clutterbuck.

Davey, Joseph Morgan,

Shelone House, Briton Ferry, Glam.

Analytical Chemist. Assistant Chemist to the Briton Ferry Works, Ltd., 1890—1894. Chief Chemist to the Albion Steel Co., Ltd., 1894—1901. Chief Chemist to the Briton Ferry Works, Ltd., 1901 to present time.

Herbert Eccles. *W. Gowland.*
Geo. R. Thompson. *Edwd. Riley.*
Pattinson B. Melmore *J. E. Stead.*

Davies, John Llewelyn,

8, Rugby Road, Neath.

Science Master. Natural Science Tripos, University of Cambridge, Part I, 1904, 1st Class, Chemistry one of the subjects; Part II, 1905, 2nd Class, Chemistry the only subject.

G. D. Liveing. H. O. Jones.
W. J. Sell. T. B. Wood.
H. J. H. Fenton.

Doull, John,

8, Lauriston Place, Edinburgh.

Brewer and Chemist (Archd. Campbell, Hope, and King, Ltd., Edinburgh). Studied Chemistry under J. Falconer King, Analyst for City of Edinburgh, &c. Also under John Hunter, Analyst for County of Midlothian, &c., and under Dr. Mackenzie, Heriot-Watt College. Medallist in Brewing, City and Guilds of London Institute. First

Class Honours Certificate in Brewing, City and Guilds of London Institute. Honorary Secretary of the Scottish Section, Institute of Brewing.

John S. Ford. John Hunter.
John M. Guthrie. Lawrence Briant.
J. Falconer King.

Dunlop, Harry,

Cragdarroch Cove, Dumbartonshire.

Analytical Chemist. For six years Student and Assistant to Messrs. R. R. Tatlock and Thomson, Public Analysts, Assayers, and Gas Examiners. Two years' experience in manufacture of Soap and Allied Products. Special work. Analysis and Investigations relating to Oils. Joint paper with Mr. R. T. Thomson on "Cod-liver Oil and other Fish Oils."

R. R. Tatlock. Thomas Gray.
J. Falconer King. James McLeod.
R. T. Thomson. *John Clark.*

Gall, John Beaconsfield,

"Knoxland," Erith Road, Belvedere, Kent.

Chemist. Associate of the City and Guilds Institute. Fellow of the Institute of Chemistry.

Henry E. Armstrong. William A. Davis.
Gerald T. Moody. Bertram Blount.
Arthur G. Levy.

Haig, Sidney Montague,

St. Edmund's Avenue, Port Hill, Stoke-on-Trent.

Brewer. Student at Royal College of Science, London; Berlin Brewing Institute; Brewing School of Technology, Manchester; Chemist and Brewer at Parker's Brewery, Burslem, Staffs.

W. J. Pope. F. G. Richards.
Jas. Grant. F. S. Sinnatt.
Stanley J. Peachey.

Hart, Alfred,

Norman Avenue, Hawksburn, Victoria, Australia.

Analytical Chemist. M.A., B.Sc., Melbourne University, Victoria, Australia. First Class Honorman, Chemistry, Melbourne University. (Formerly) Science Master, Church of England Grammar School, Melbourne. (Now) Chemist to Messrs. Lewis and Whitty, Manufacturers, Flinder's Lane, Melbourne, Victoria, Australia.

Robert Law. D. Avery.
Orme Masson. *F. R. Power.*
Fred. W. Steel. *A. W. Craig.*

Hayman, Jack Vernon Johnson,

Tringhurst, Cranleigh, Surrey.

Analytical Chemist to Cement Works. Three years' course in Chemical Department, Central Technical College, S. Kensington, gaining Diploma of Associate (A.C.G.I.); late Assistant Chemist to Messrs. Henry Faija and Co., Westminster; late Research Chemist Messrs. Harnett, Ltd., Stratford; now Chemist to Messrs. Robert Stephenson and Son, Ltd., Cement Manufacturers, Burwell, near Cambridge.

Henry E. Armstrong.	William Robertson.
Gerald T. Moody.	Robert J. Caldwell.
T. Martin Lowry.	Robert Stephenson.

Higgins, John Michael,

39, Queen Street, Melbourne.

Consulting Metallurgist. Member Pharmaceutical Society (Aust.), Major Examination. Certificated Student, Bendigo School of Mines, for Chemistry and Metallurgy.

G. C. McMurtry.	Edward H. Rennie.
T. J. Greenway.	L. R. Scammell.

G. A. Goyder.

Hill, William Basil,

Eastfield, Stockton Lane, York.

Tanner (of Hill Bros., Foss Islands Tannery, York). Student in the Leather Industries Laboratory in the Yorkshire College, Leeds, 1895—6. Member of the Society of Chemical Industry. Associate of the International Association of Leather Trades Chemists.

J. H. Ashwell.	Henry R. Procter.
Arthur Smithells.	Geo. Ward.
Thomas Fairley.	B. A. Burrell.

Oliver Quibell.

Hobsbaum, Isaac Berkwood,

79, Claremont Road, Forest Gate, London, E.

Analytical, Research, and Works Chemist. I am a holder of the Diploma of the School of Technology, Manchester, where I studied under Dr. E. Knecht and Prof. W. J. Pope, F.R.S., and for 2½ years have been engaged in Manufacturing Chemistry at Manchester, Sheffield, and now with A. Boake Roberts, of Stratford, London.

William J. Pope.	L. G. Radcliffe.
Jul. Hübner.	Jas. Grant.

F. S. Sinnatt.

Hollins, Cecil,

34, Beamsley Road, Frizinghall, Yorks, or 137, Firs Lane, Leigh, Lancashire.

Assistant Master in the Leigh Grammar School. Akroyd Scholar at the Leeds University, 1902—5. I am desirous of keeping in touch with the latest developments of Chemistry.

Arthur Smithells. W. Lowson.
J. B. Cohen. C. E. Whiteley.
W. H. Leek.

Jack, Maurice Brooks,

66, Burma Road, Clissold Park, N.

Wholesale Druggists, &c. (Manufacturing), Junr. Director. Six years' practical experience in every branch of manufacture of Chemists' and Druggists' sundries, in the making of Pharmaceutical preparations, and of synthetic perfumes; good general analytical experience. Have devoted most of spare time during past 5 years to study of Chemistry at the City of London College. Holder of Certificates in Chemistry, both Theoretical and Practical, from the City of London College and the Board of Education.

Isaac S. Scarf. Harold W. Harrie.
Charles A. West. *E. J. Jackman.*
J. C. Mascarenhas.

Jones, Edward Towyn,

17, Bloomsbury Square, London, W.C.

Assistant Lecturer in the Dept. of Chemistry and Physics at the School of Pharmacy (Pharmaceutical Society), London. B.Sc. (Wales), with 1st Class Hons. in Chemistry, 1904. Junior Demonstrator of Chemistry at the Univ. College of N. Wales, Bangor, 1904–5. Assistant Lecturer and Demonstrator of Chemistry at the School of Pharmacy (Pharmaceutical Society), London, 1905.

Arthur W. Crossley. James J. Dobbie
Kennedy J. P. Orton. Alexander Lauder.
Allan Baguley. *Charles E. Fawsitt.*

Law, Herbert Drake,

152, Brixton Rd., S.W.

Assistant Lecturer, Borough Polytechnic. B.Sc., 1st Hons. Published work: "Estimation of Nitrogen," Society of Chemical Industry, June, 1902; "Electrolytic Oxidation of Aromatic Hydrocarbons," Faraday Society, October 25, 1904; "Electrolytic Oxidation of Aldehydes," *Trans.*, February, 1904.

F. Mollwo Perkin. C. H. Desch.
T. Martin Lowry. George Beilby.
Alfd. C. Chapman.

Lyon, Rudolph,

400, Huddersfield Road, Halifax.

Analytical Chemist and Manager of Halifax Sewage Works. Four years under T. Fairley, Esq., F.R.S.E., &c., and five years' experience since as Chemist under The Bradford Dyers' Association, Messrs. Brotherton & Co., Messrs. Murphy and Lonsdale, and the Halifax Corporation.

Thomas Fairley.	B. A. Burrell.
A. J. Murphy.	Edward Halliwell.
H. W. Watson.	H. D. Dakin.
Arthur W. Cooke.	*James Ashton.*

McCleary, William,

61, Station Road, Pendlebury, Nr. Manchester.

Demonstrator in Practical Bleaching, Dyeing, and Finishing at the Municipal School of Technology, Manchester. First Class in Theoretical and Practical Chemistry. Joint Author in "The Chemistry and Practice of Finishing."

B. Prentice.	Jno. L. Whiteside.
J. R. Appleyard.	E. Green.
R. L. Taylor.	Percy Bean.

Frank Crossley.

MacKechnie, Robert Drysdale,

Sycamore Cottage, Pitsea, Essex.

Technical Chemist. Three years' training in analytical chemistry and allied sciences at Anderson's College, Glasgow; one year's training in Metallurgy at Technical College, Glasgow, subsequently assistant to Dr. A. P. Aitken, Edinburgh; chemist to Messrs. Tennant & Co., of Carnoustie, at present chemist-in-charge at British Explosives Syndicate, Ltd., Pitsea.

Robert J. Caldwell.	J. Wyclif Black.
Frederick Robertson.	J. A. Williamson.

William Robertson.

Martin, Harry,

14, Hardman Street, Liverpool.

Chemist and Druggist. Member of the Pharmaceutical Society. Attended elementary and advanced courses of chemistry under Prof. Norman Collie, F.R.S., &c., at the School of Pharmacy of the Pharmaceutical Society. Later, chief assistant in the wholesale pharmaceutical laboratory of Messrs. Brady & Martin, of Newcastle-on

Tyne. Now Director of Messrs. Symes & Co., Ltd., Liverpool, Manufacturing, Analytical, and Dispensing Chemists. Honorary Secretary of the Liverpool Chemists' Association.

John Norman Collie.	N. H. Martin.
Arthur Lapworth.	Prosper H. Marsden.
M. Carteighe.	John C. Hewlett.

Walter Hills.

Micklewright, Harry George Fletcher,
116, St. James's Road, Croydon.

Science Master at Whitgift Grammar School, Croydon. B.A. Oxon. 1903. 1st Class Final Honour School of Natural Science (Chemistry). I am engaged in teaching Chemistry, and am desirous of keeping in contact with the developments of the science.

W. W. Fisher.	N. V. Sidgwick.
J. E. Marsh.	*R. de J. Fleming Struthers.*
John Watts.	*A. Angel.*

Modi, Edalji Manekji,
Opposite Grant Road Station, Sleater Road, Bombay.

Manufacturing and Consulting Chemist and Chemical Analyst and Technologist, Managing Director of the Arthur Road Chemical Works, Bombay, Life Member of the Society of Chemical Industry (London), Member of the Bombay Textile and Engineering Association, Life Member of the Bombay Sanitary Association, &c. After passing University Examinations (theoretical and practical) in Physics, Inorganic and Organic Chemistry, and Toxicology, from the Grant Medical College, Bombay, some 18 years ago, devoting time and energy to chemical pursuits, doing analytical and industrial research work at the Bombay Techno-Chemical Laboratory, since its start, directing for the last 15 years unremitting attention to utilisation of different raw and waste materials produced in India in the successful manufacture (by simple and economical processes) of various chemical products for the Engineering and Textile Industries as well as in the line of Disinfectants, and being the Patentee and Proprietor of numerous useful Specialities largely used and appreciated by H.M.'s Indian Government and numerous leading Mills, Railways, Steamships, &c.

T. K. Gajjar.	*A. Pell.*
K. B. Jadhava.	*A. Sanyal.*
Gopal C. Banerjee.	*C. L. Bose.*

P. C. Rây.

Morris, Eric Haydn-,

c/o Messrs. G. Mowling & Son, Chemical Works, Footscray, Melbourne, Victoria, Australia.

Assoc. of the Incorporat. Inst. of Analysts, Assayers and Metallurgists of Victoria. Manager and Head Chemist, now and for 2½ years past, at a soap and candle, soap, glycerine and oil works, Melbourne, Australia. I had charge of Messrs. Jos. Crosfield & Sons', Ltd. (alkali, soap, glycerine, and chemical mfrs.) laboratory at Liverpool for two years. During my studentship I attended science lectures at Liverpool University College, also at Liverpool School of Science, Technology and Art. Am now and have been for 3 years Head Chemist and manager to G. Mowling & Son, soap, candle, oil and glycerine manufacturers, Melbourne, Australia. Being engaged in analytical and technical work, I am desirous of joining this society in order to receive their publications and to keep myself abreast of latest chemical researches at home.

A. H. Jackson.	*D. Avery.*
Henry W. Levy.	*A. W. Craig.*
W. E. Field.	*F. R. Power.*

Robert Law.

Motion, John.

Edgewater, N.J.

Chemist. Assist. Chemist with Messrs. J. & P. Coats, Paisley, Scotland, 1891—1895. Assistant Chemist at Parkhead Forge (Steel Works and Rolling Mills), Glasgow, Scotland, 1895—1897. Since 1897, Chemist for Valvoline Oil Co., Edgewater, N.J.

Wm. App Jones.	Edward C. Worden.
Benj. L. Murray.	T. Lynton Briggs.

Virgil Coblentz.

Neville, Henry Allen Dugdale,

81, Revidge Road, Blackburn, and the County Technical Laboratories, Chelmsford.

Lecturer and Demonstrator in Chemistry. B.Sc. (Lond.). Associate of the Institute of Chemistry. Formerly Assistant Demonstrator in Chemistry at the Municipal School of Technology, Manchester, and Assistant Lecturer and Demonstrator in Chemistry at the Municipal Technical School, Blackburn. Now Lecturer on Chemistry at the County Technical Laboratories, Chelmsford. Joint author of the following papers in the Journal of the Chemical Society: with R. H. Pickard, D.Sc., Ph.D., "Note on Pyromucylhydroxamic Acid" (1901), with W. J. Pope, F.R.S., "Optically Active Selenium Compounds"

(1902); with R. H. Pickard, D.Sc., Ph.D., "Optically Active Carbimides."

William J. Pope. Jul. Hübner.
Robert H. Pickard. A. S. Elford.
Thos. S. Dymond.

Penn, Francis Richard,

Highthorne Tce., Shadwell Lane, Moortown, Leeds.

Teacher of Chemistry. Assoc. R.C.S., Lond. Chemistry, 1st Class, 1893—6. Inter. B.Sc., Lond. First in 1st Class Hons. Chemistry, 1901. Teaching Scholar in Chemistry, R.C.S., Lond., 1896–98. Teacher of Chemistry in Central Higher Grade School, Leeds, 1898—present date. Teacher of Chemistry, &c., to evening students in Technical School of Leeds Institute, 1902—present date.

William A. Tilden. Chapman Jones.
M. O. Forster. W. Palmer Wynne.
G. T. Morgan. Beeby Thompson.
S. Parrish.

Perkins, Hugh Donald,

"Dodwell," Bursledon, Hants, England.

Second Assistant in the Country Liquors Investigation Laboratory. Student at Hartley University College, Southampton, under Dr. D. R. Boyd. Assistant to J. T. Norman, Esq., City Central Laboratory, London. At present engaged under the Indian Government, at Kasauli, Punjab, as above.

R. L. Jenks. D. R. Boyd.
John T. Norman. T. E. Thorpe.
J. Brierley.

Phipson, Percy Barker,

c/o J. Staples and Co., Ltd., Wellington, New Zealand.

Brewer and Chemist. Chemist to the City Brewery Company, Lichfield, England, for 2 years, and for the last 4 years have acted as Chemist to J. Staples and Co., Ltd., Wellington, N.Z. My reason for desiring admission to the Chemical Society is that, living in so isolated a position, I am anxious to obtain the Chemical Society's Journal, so as to keep in touch with the latest developments in Chemistry.

H. W. Lawrence. J. S. Maclaurin.
Thomas H. Easterfield. *B. C. Aston.*
Geo. M. Thomson.

Pooler, Frederick John,

The Boys' High School, Grahamstown, Cape Colony.

Science Master at above school. B.Sc., Birmingham University, in

Physics, Chemistry, and Maths. Honours, Part II, Theoretical Chemistry, S. Kensington, 1902. For 2¼ years Chemistry Master at the Higher Grade School, Jarrow-on-Tyne. For 5½ years assistant to Dr. R. A. Lyster, B.Sc., M.B., &c., the Technical School, Smethwick, Birmingham. At present Chemistry and Maths. Master at Grahamstown. As a Teacher of Honours Practical Chemistry in N. of England, I met with considerable success, my students being the *only* successful ones for many years in the district.

W. E. S. Turner. T. Slater Price.
J. Newton Friend. D. F. Twiss.
Arthur Adams.

Rigby, Thomas,
23, The Square, Fairfield, Manchester.

Chief Engineer, Power Gas Dept. of Crossley Bros., Ltd., Openshaw. A student of Chemistry for some years. Designer of special apparatus for the treatment of guns, armour plates, and the products of various chemical and metallurgical processes. Designer of special gas-producing plants for the utilisation of all kinds of carbonaceous fuels, and has done special research work in these and in the recovery of the original nitrogen in the fuels in various forms, as, for instance, sulphate of ammonia. I wish to have the proceedings of the Society to keep in touch with modern chemical science.

Fredc. H. Bowman. Ernest Wheeler.
G. H. Bailey. *F. E. Bowman.*
W. H. Bentley. *Percy Bean.*
F. W. Skirrow. *Frank Crossley.*

Rowland, James Frederick Fothergill,
5, St. James's Park, Croydon.

Science Teacher. Am a B.A., Cambridge, and an Internal Student of Lond. Univ., studying for Hons. at B.Sc. in Chemistry. Am Senior Science Master at the Whitgift Middle School, Croydon (350 boys). Have studied Chemistry practically in Dr. Wynter-Blyth's Laboratory, engaged in a research on the distribution of nitrates in the Vegetable Kingdom.

A. Wynter-Blyth. J. C. Crocker.
J. Bernard Coleman. F. H. Lowe.
W. E. Oakden.

Royle, Harold Marmion,
12, Barfield Villas, George Lane, South Woodford, Essex.

Chemist at the Gas Light and Coke Co., Beckton Gas Works, Beckton, Essex. Assistant Chemist at Messrs. Johnson Saccharum Co., Ltd., for 18 months. Chemist at the London Distilling and Yeast

Co., Ltd., for 4 years. Chemist at the Beckton Gas Works for 5 years and up to the present time. Object in joining the Society to obtain the current Chemical Literature.

L. J. de Whalley. Thomas Tyrer.
B. E. R. Newlands. *David Howard.*
D. Lloyd Howard.

Ruston, Arthur Gough, B.A., B.Sc. (Lond.),
244, Oxford Road, Reading.

Schoolmaster. Senior Science Master, Kendrick School, Reading. Demonstrator in Chemistry, University College, Reading. Desirous of keeping abreast of Chemical work and perfecting his knowledge of the Science.

C. M. Luxmore. John Percival.
E. K. Hanson. J. W. Dodgson.
C. W. Walker-Tisdale.

Schnurmann, Harry Nestor-,
Corinth House, Cheltenham.

Assistant Lecturer and Demonstrator in Metallurgy to the University of Birmingham. Mining and Metallurgical Education at Redruth School of Mines (Cornwall) and Massachusetts Inst. of Technology, Boston, U.S.A. Author of paper on Micro-structure of Copper (Inst. of M. and M.); co-patentee of Copper Tapping Apparatus, &c.

Thomas Turner. J. Paul de Castro.
Edmund F. Hudson. *Harry Silvester.*
Alex. Findlay.

Setterington, Douglas Temple,
45, Regent Road, Blackpool, Lancs.

Teacher of Chemistry. Inter. B.Sc. (London). Lecturer in Chemistry at the Blackpool Secondary School, P. T. Centre and Technical School. Author of "Easy Quantitative Exercises in Chemistry."

Frank E. Weston. Morton E. Wager.
Henry R. Ellis. J. Hart-Smith.
John Wilson.

Tillot, John Booty,
55, Wood Street, Westminster, S.W.

Analyst. Pharmaceutical Chemist. Member of Pharmaceutical Society. Scientific training received at Borough Road and Chelsea Polytechnic Institutes. At present engaged in analytical work in conjunction with A. E. Bell, Esq., F.I.C., F.C.S.

Albert Edward Bell. H. F. Brand.
F. Mollwo Perkin. *John C. Umney.*
W. A. H. Naylor.

Tutin, Frank,
49, The Avenue, Kew.

Research Chemist in the Wellcome Chemical Research Laboratories. Joint author of papers published in the Society's Journal.

Frederick B. Power. R. M. Caven.
F. Stanley Kipping. H. A. D. Jowett.
Frederic H. Lees.

Walpole, George Stanley,
349, Queen's Rd., Battersea Pk.

Research Chemist. Bachelor of Science, Melbourne University (1st Hons. Chemistry). Author of Paper, *Proc. Roy. Soc., Victoria*, Vol. XVII, Pt. II, Article XIV. Research Studentship, Lister Institute of Preventive Medicine, Chelsea, 1905.

Henry E. Roscoe. Harold G. Colman.
Arthur Harden. *J. Norman Collie.*
J. Paul de Castro.

White, John Ledger,
73, Cambridge Mansions.

Assistant Lecturer in Chemical Department, Battersea Polytechnic, S.W. D.Sc. (Durham) in Chemistry. Two years Private Assistant to Professor Bedson, D.Sc., &c.; one year Works Chemist to Messrs. Addison, Potter & Sons; two years Assistant Lecturer and Demonstrator, Armstrong College; seven years Assistant Lecturer and Demonstrator, Battersea Polytechnic.

P. Phillips Bedson. J. T. Dunn.
F. C. Garrett. John Wilson.
S. Hoare Collins.

Williams, Gerard William,
P.O. Box 21, Germiston, Transvaal, S.A.

Metallurgical Chemist. Consolidated Goldfields of S.A., Ltd. Cambridge, 1898, 1900. 1st Class Nat. Science, Tripos, 1900. Journal of Chemical, Metallurgical, and Mining Soc. of S.A. Papers on "The Determination of Constants in Working Cyanide Solutions."—Gold Medal. Also paper on other matters in connection with cyanide process, &c.

W. A. Caldecott. W. H. Jollyman.
James Moir. H. J. H. Fenton.
W. J. Sell.

The following Certificates were authorised for presentation to ballot by the Council under Bye-Law I (3) :—

Anthony, Charles, jun.,

Town Hall, East London, C.C., South Africa.

Civil Engineer and Water-Supply Expert; M. Inst. C.E., M. Am. Soc. C.E., Mem. San. Inst., F.R.A.S., &c. Received chemical training at the Royal School of Mines, Bristol, and subsequently at the University Laboratory, Cambridge. When in the Argentine the Government placed the Mint Laboratory at his disposal.

Robert Warington. *A. John Gregory.*
Charles Mills. *Walter D. Severn.*

Millen, John Dunlop,

Launceston, Tasmania.

Metallurgist and Metallurgical Chemist, Mount Bischoff Co. Fellow of the Geological Society, Associate of the Sydney Technical College, Lecturer at the Launceston Technical College in Chemistry, Metallurgy, &c.

George Stone. *F. B. Guthrie.*
Henry G. Smith.

Rowley, Henry,

Perth, Western Australia.

City Analyst and Bacteriologist. Twenty-five years' experience investigative chemistry. Electro-metallurgy and research engineering; gold extraction and deposition of metals; chlorine processes, &c. (assistant, Prof. Cosmo Newberry). Lecturer Government Technical Schools, Tasmania, Electricity, Electro-Chemistry, and Metallurgy. Ex-Examiner in Practical Chemistry to Pharmaceutical Society, West Australia. Member Inst. Elect. Eng., London. Member Soc. Pub. Analysts, London.

Edward S. Simpson. F. S. Earp.
Percy Appleyard.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 15/12/05

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 301.

Thursday, December 7th, 1905, at 8.30 p.m. Professor R. MELDOLA, F.R.S., President, in the Chair.

Mr. T. W. Firth Clark was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

George Ernest Banner, Brooklyn, Highfield Rd., Rock Ferry, Cheshire.
Arthur Ernest Barker, B.A., B.Sc., 3, York Rd., Chorlton-cum-Hardy.
Charles Frederick Polwhele Bletchley, B.A., Downside College, Bath.
Arthur Forbes Braid, Rose Mount, Dumbreck, Glasgow.
William Caldwell, M.A., Mont-Cecil, Bloomfield, Belfast.
Reginald William Lane Clarke, 15, Torridon Rd., Hither Green, S.E.
William Boulton Conyingham, "Sandon," Ballsbridge, Co. Dublin.
Frederick Watkins Evans, 3, Charlotte Street, Hull.
Hans Eduard Fierz, Ph.D., Clydach-on-Tawe, Glamorg., Wales.
William Henry Matthews Jones, Leyden Villa, Chester.
George Frederick Wesley Martin, 14, Castle Park, Lancaster.
John Edmund Pitman, B.Sc., Hartley Univ. College, Southampton.
Harold Rogerson, M.Sc., 46, Bloomsbury St., Bedford Square, W.C.
Frank Smith, B.Sc., 407, Church Road, Smithills, Bolton.
Percy Charles Thornton, 9, Cantwell Road, Plumstead, S.E.
Ronald William Tonkin, 37, Oakill Road, Putney, S.W.
Elkan Wechsler, Ph.D., 59, Petherton Road, Canonbury, N.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

Adam Lawson Kelly Adam.
C. Chester Ahlum.
James Edward Alcock.
James Albert Allison.
Charles Anthony, jun.
George Henry Barbrook.
Marmaduke Barrowcliff.
John Coggin Brown, B.Sc.
Bryce Chudleigh Burt, B.Sc.
Joseph Edward Coates, B.Sc.
Douglas Henry Bellars Cowman.
Arthur Augustine Dallman.
Joseph Morgan Davey.
John Llewelyn Davies, B.A.
John Doull.
Harry Dunlop.
John Beaconsfield Gall.
Sidney Montague Haig.
Alfred Hart, M.A., B.Sc.
Jack Vernon Johnson Hayman.
John Michael Higgins.
William Basil Hill.
Isaac Berkwood Hobsbaum.
Cecil Hollins.
Maurice Brooks Jack.
Edward Towyn Jones, B.Sc.
Herbert Drake Law, B.Sc.
Rudolph Lyon.
William McCleary.
Robert Drysdale MacKechnie.
Harry Martin.
Harry George Fletcher Mickle-wright, B.A.
John Dunlop Millen.
Edalji Manekji Modi.
Eric Haydn-Morris.
John Motion.
Henry Allen Dugdale Neville, B.Sc.
Francis Richard Penn.
Hugh Donald Perkins.
Percy Barker Phipson.
Frederick John Pooler, B.Sc.
Thomas Rigby.
James Frederick Fothergill Rowland, B.A.
Henry Rowley.
Harold Marmion Royle.
Arthur Gough Ruston, B.A., B.Sc.
Harry Nestor-Schnurmann.
Douglas Temple Setterington.
John Booty Tillot.
Frank Tutin.
George Stanley Walpole, B.Sc.
John Ledger White, D.Sc.
Gerard William Williams, B.A.,

Of the following papers, those marked * were read:

*202. **"The constitution of nitrites. Part I. Two varieties of silver nitrite." By Prafulla Chandra Rây and Atul Chandra Gañguli.**

It has generally been maintained that silver nitrite has a nitronic or non-oxylic constitution (Divers, *Trans.*, 1883, **43**, 455; 1885, **47**, 205), but Emerson Reynolds seems, however, to be of opinion that "isomeric metallic nitrites of both the types (oxylic and imidic) exist which are also tautometric in a marked degree" (*Trans.*, 1903, **83**, 643).

The close analogy between mercurous nitrite and the corresponding silver compound has all along been pointed out in some of the authors' previous memoirs, and it would appear that under the action of heat the former behaves as if it had a twofold constitution, as indicated by $Hg{\cdot}NO_2$ and $Hg{\cdot}O{\cdot}NO$ respectively (*Trans.*, 1903, **83**, 491).

In the present communication, the authors hope to establish that silver nitrite also has this dual character, the two varieties being now described under the designation of α- and β-compounds respectively.

The α-Variety of Silver Nitrite.—This is the substance prepared by double decomposition between solutions of silver nitrate and sodium nitrite. The precipitate, consisting of a mealy crystalline powder, is drained at the pump, thoroughly washed with cold water, and dried under diminished pressure over sulphuric acid. The method of experiment was exactly the same as already described (*Trans.*, 1905, **87**, 180). In the experiment of Divers and Shimidzu, after the apparatus had been exhausted the flow of mercury in the fall tube was stopped so as to allow the nitrous fumes evolved during the heating of the salt to act on the metallic silver set free, thereby favouring the formation of silver nitrate and nitric oxide (*Trans.*, 1885, **47**, 634). In the present instance, the reverse method was followed. The rate of the flow of mercury was increased during the operation. By this arrangement the nitrous fumes were swept out of the tube almost as fast as they were generated, thus giving them much less chance of coming into contact with the silver. Moreover, these being absorbed by the caustic potash in the spiral, not only was the "soiling" of mercury in the Sprengel pump guarded against, but also the formation of nitric oxide by the secondary reaction between mercury and nitrous fumes prevented.

As it was desirable that the heating should be effected at a definite temperature, an asbestos box was made fitted up with mica windows; when the bath had reached the required temperature, the portion of the glass tube containing the substance was introduced into it through an opening. The various stages in the decomposition could also be easily watched through the mica plates.

The salt, when heated at temperatures ranging between 220° and 250°, fused, evolving red fumes. The gas which was collected in the reservoir of the pump was completely absorbed by a solution of ferrous sulphate, thus proving it to be nitric oxide. The residue solidified into a hard lump, consisting of a mixture of metallic silver and its nitrate. So far as this experiment goes, Divers' results are confirmed. The silver nitrite breaks up according to the equation: $2Ag{\cdot}NO_2 = 2Ag + N_2O_4$ (1); at the same time, a portion of the silver thus set free acts upon the nitrous fumes, giving rise to silver nitrate and nitric oxide: $Ag + NO(NO_3) = AgNO_3 + NO$ (2).

The β-Variety of Silver Nitrite.—The silver nitrite as prepared above is dissolved in boiling water, and from the hot saturated solution the nitrite is allowed to crystallise; when the mother liquor becomes lukewarm, it is decanted into a shallow evaporating dish. When left over-

night, slender needles are formed, which are drained and dried as above.

The heating was effected at exactly the same temperatures as in the preceding experiment, namely, between 200° and 250°. Very slight red fumes were noticed, and the substance did not fuse. The gas collected was not absorbed or coloured by a solution of ferrous sulphate, but was completely absorbed by a solution of alkaline pyrogallate, thus proving to be oxygen. As the salt did not fuse, the filamentous character of the original crystals was kept intact; the residue, on treatment with hot water, did not give the faintest opalescence with hydrochloric acid, and, when struck with a hammer, it solidified into a shining regulus of metallic silver.

The results are noteworthy in more respects than one. In the present instance, any formation of silver nitrate is out of the question. This salt is a stable compound, and it decomposes only slightly even at 444° (Divers, *Trans.*, 1899, **75**, 83). It cannot, therefore, be urged that a little silver nitrate is at first formed, which breaks up and yields oxygen according to the equation: $2AgNO_3 = 2Ag + N_2O_4 + O_2$.

The oxylic constitution of silver nitrite, however, offers an easy explanation. Under the action of heat, the scission takes place as indicated by the dotted lines: $Ag\text{⋮}O\text{⋮}NO$.

Thus, from every two molecules of silver nitrite two molecules of nitric oxide and one molecule of oxygen are simultaneously set free. Now, although a mixture of these two gases in this proportion probably gives rise ordinarily to the peroxide, when it is rapidly drawn through or shaken up with a solution of caustic potash, the whole of the oxygen is not fixed, and a portion of it escapes uncombined. In short, the success of Gay-Lussac's method of preparing potassium nitrite is based on this fact (*Trans.*, 1899, **75**, 85).

It is also remarkable that although a slight quantity of nitrous fumes was noticed, not a trace of silver nitrate was formed under the conditions present. Some dozen experiments were performed with samples of silver nitrite from separate preparations confirming the above results. We give below the result of one typical experiment.

0·43 gram of salt gave 0·3 gram of silver and 35·2 c.c. of moist nitrogen (extracted from the alkali in the spiral) at 32·5° and 754 mm. Found* Ag = 69·76; N = 8·70; calculated Ag = 70·13; N = 9·09 per cent.

The ratio of nitritic to nitratic nitrogen was as 5 : 3·8. The oxygen collected was 2·6 c.c. at the above temperature and pressure.†

* The percentages of nitrogen and silver are rather low, but it should be remembered that the crystals, from the method of preparation, necessarily contained a trace of included mother liquor.

† If the whole of the oxygen were absorbed, the alkali, on examination, would have yielded nitritic and nitratic nitrogen in equal quantities. A few experiments

In conclusion, the authors wish it to be distinctly understood that a sharp line of demarcation cannot always be laid down between the fusible and the infusible varieties. As a result of experience gained during the course of several dozens of preparations, it has been found that even under exactly similar conditions the α-variety often turns out to be largely admixed with the β-variety; but the evidence of the formation of the latter in the pure state has been unmistakable.

It is to be hoped that further light will be thrown on the constitution of silver nitrite by the determination of specific gravity, as also by interaction with ethyl iodide.

*203. "The products of heating silver nitrite." By Edward Divers.

One of the purposes of this paper is to show that Rây and Gañguli, in the course of their interesting work on the effects of heating silver nitrite, have met with nothing which supports the belief that there are two chemical varieties of that salt. The other purpose of the paper is to endeavour to increase the confidence in the accuracy of their important experimental results, which are hardly in accordance with current views concerning the oxides of nitrogen.

Accounts of experiments on the effects of heating silver nitrite already published will be found in the following publications (*Trans.*, 1871, **24**, 85; *Proc. Roy. Soc.*, 1871, **19**, 429; and *Trans.*, 1885, **47**, 634; and 1899, **75**, 111). Precipitated and washed silver nitrite seems always to give some nitrate when heated, but, according to Rây and Gañguli, fractional recrystallisation of the precipitated salt, effected by dissolving it in hot water and slowly cooling, gives as the last fraction crystals which may be so heated as to decompose without yielding any nitrate at all. The term fractional crystallisation is here used as appropriate, because the authors state that the salt before recrystallising often behaves as though it were a mixture of its two forms, that which does not give nitrate and that which does, although on what grounds it is difficult to understand. They seem to have

with lead nitrate under conditions exactly similar to the above were made, the only difference being that the substance was heated to a much higher temperature. The mean of three experiments gave the percentage of nitrogen as nitrate = 4·21, as nitrite = 4·21, whilst the percentage of oxygen was 4·6. According to the equation $Pb(NO_3)_2 = PbO + 2NO_2 + O$, these proportions should be N = 8·48 and O = 4·84. Hence it is clearly established that nitric peroxide, even when mixed with oxygen, in reacting on an alkali, yields the nitrate and nitrite in equal amount, the oxygen passing off unabsorbed. A trace of a higher oxide of lead which is found in the intermediate stage in the residue appears from its colour to be red lead (compare Divers, *Trans.*, 1899, **75**, 84). These experiments also prove the trustworthiness of the method employed.

made no inspection of the precipitated salt under the lens, in order to seek for two forms of crystals. No distinction can be made as regards any essential difference between "a mealy crystalline powder" and "slender needles," since the former is only the result of hasty crystallisation during precipitation, and the latter are only obtained by slow crystallisation. The former variety of the salt, we are told, fused when heated at 220° and above; the latter variety did not in the least fuse. This statement cannot, however, be accepted as evidence, since silver nitrite does not fuse, but decomposes freely at about 180°, and will do so quickly and completely at that temperature without any fusion of its products of decomposition taking place. What does fuse in the decomposition of silver nitrite at 220—250° is any silver nitrate produced, this salt melting below 217°.

The remaining difference observed in the nature of the decomposition products of the two forms of silver nitrite supplies, however, no grounds whatever for stating, as Rây and Gañguli have done, that the essential or primary decomposition is into silver and nitric peroxide in the one case, and into silver, nitric oxide, and oxygen in the other, since in this instance the one volume of oxygen and the two of nitric oxide will soon become nitric peroxide also. All that these authors can look to as marking the distinction which they believe to exist, is that they get, exclusive of products common to the two cases, some nitrate and some residual nitric oxide in the one case, whilst in the other, under the same conditions of procedure, they get paler gases and can isolate from them a little oxygen.

There is not much difficulty in finding a sufficient reason for this difference of behaviour in the different way in which the salt will pack itself in the tube in the two cases. When the salt is heated in the state of powder the resulting gases will be temporarily imprisoned in the interstices of the mass and the heat will penetrate it slowly enough to permit of the metallic silver of the already decomposed part being acted on by the gases evolved from the still decomposing parts of the nitrite. In this way nitrate will be formed and the gases made to contain a greater proportion of nitric oxide than would otherwise be the case. If, too, it be assumed that the gases are primarily oxygen and nitric oxide, their detention in the residual mass will give time for their union, more or less, into nitric peroxide and thus account for the redder colour of the resulting gases. On the other hand, when the nitrite is in the form of slender needles, the slight contact of the needles with each other and with the walls of the tube, together with their open arrangement in the tube, will cause the whole mass of the salt to be decomposed so quickly and so nearly simultaneously by the heat suddenly radiated on it from the walls of the heating chamber employed, that, with the vacuum maintained, there will be no temporary detention

of the gases by the solids, and no time, therefore, for secondary actions to take place. Not even the production of much nitric peroxide by the union of the oxygen with the lower oxide of nitrogen should be possible before the gases have reached the potassium hydroxide solution.

Rây and Gañguli attempt to strengthen their position that there are two constitutionally different silver nitrites by claiming that, in conjunction with Sen, one of them has shown already (*Trans.*, 1903, **83**, 491) that the decomposition of mercurous nitrite by heat indicates that this salt also has a twofold constitution. They make no reference, however, to the fact that the present writer denied at the time (*Proc.*, 1903, **19**, 78) that they had sufficient grounds for maintaining that view. Much mercurous nitrate was formed in their experiments, along with a very little red oxide, and to the production of this oxide they attached special significance, unmindful of the familar fact that mercurous nitrate itself readily yields mercuric oxide when moderately heated.

Naturally some scepticism will be felt as to the correctness of Rây and Gañguli's implication that oxygen and nitric oxide, mixed in the proportion to form nitric peroxide, can remain for any observable time without passing wholly into combination as that compound. Quite recently, however, any ground for that scepticism has been largely, if not wholly, removed. Raschig (*Zeit. angew. Chem.*, 1905, **18**, 1281) has just shown by convincing experiments that the two gases take only a small, although measurable, fraction of a second to combine to the extent necessary to form, what must be taken to be, nitrous anhydride, thus: $(x+1)O_2 + 4NO = xO_2 + 2N_2O_3$, and that the anhydride then very much more slowly oxidises into nitric peroxide. No difficulty, therefore, need be felt in accepting Rây and Gañguli's results and in believing that in their experiments there was such an outburst of gases from the decomposing silver nitrite—rapidly and uniformly heated in a vacuum to a temperature much above its decomposing point—as to cause the gases to travel 5 cm., or whatever was the distance, to reach the potassium hydroxide solution in a fraction of a second short enough to save some of the oxygen from passing into combination as nitric peroxide. If this be felt to be the case, it will be seen that Rây and Gañguli have indeed done excellent work in their indirect confirmation of Raschig's remarkable discovery of the slow formation of nitric peroxide.

Rây and Gañguli's results being accepted, it must be concluded that when silver nitrite is heated, it always decomposes primarily into silver, nitric oxide, and oxygen, and not that, as these chemists assume, it sometimes also decomposes into silver and nitric peroxide. It has still to be considered how the decomposition must proceed in order that oxygen and nitric oxide may be liberated together. These authors

merely suggest that the salt decomposes in the way indicated by the dots in the formula, Ag·O·NO, which, put in that way, does not assist one much. The only explanation apparently possible is that, just as silver nitrate decomposes when heated into oxygen and nitrite, so will the nitrite, in its turn, decompose or tend to decompose into oxygen and hyponitrite, the latter substance almost simultaneously becoming silver and nitric oxide. In support of the possibility of such a change, there is the fact, recorded by the present author (*Proc. Roy. Soc.*, 1871, **19**, 429), that silver nitrite, when decomposed by heat, on one occasion left a minute quantity of a bright yellow silver compound, apparently hyponitrite, which was insoluble in water and soluble in ammonia. As, however, this substance was not again obtained (*Trans.*, 1899, **75**, 111), it is uncertain whether it was really hyponitrite.

Discussion.

The **President** expressed regret that Dr. Divers had found it necessary to express dissent from the conclusions of the authors of the preceding communication, inasmuch as the salts corresponding to the tautomeric forms of nitrous acid had long been sought for. He was of opinion that no method of determining the constitution of these salts based on the study of their products of decomposition by heat was likely to lead to satisfactory results. He considered that it was by the application of organic reagents in solution, such as the alkyl iodides, that more decisive information was likely to be obtained, and was somewhat surprised that the authors had not made this next comparatively simple step in order to test the accuracy of their conclusions.

*204. "A contribution to the chemistry of benzoic sulphinide." By Frederick Daniel Chattaway.

In continuation of the author's work on the sulphonamides, the action of chlorine on benzoic sulphinide (saccharin) has been investigated. When chlorine is passed into a solution of saccharin in aqueous potassium or sodium hydroxide, a sparingly soluble solid substituted nitrogen chloride may be precipitated, or the solution may remain clear according as an equivalent quantity of caustic alkali or an excess has been used. In the latter case, on the addition of a mineral acid, a compound is precipitated which may be a sulphondichloroamido- or a sulphonmonochloroamido-acid, according as the chlorine has or has not been added in excess. When chlorine is passed into a solution of the sodium salt of saccharin, *o*-benzoic *N*-chlorosulphinide or chloro-

iminosaccharin is precipitated in accordance with the following equation:

$$C_6H_4\begin{<}{CO\\SO_2}{>}NNa + Cl_2 = C_6H_4\begin{<}{CO\\SO_2}{>}N\begin{<}{Cl\\Cl\\Na} =$$

$$C_6H_4\begin{<}{CO\\SO_2}{>}NCl + NaCl.$$

This readily dissolves in an excess of caustic alkali, forming a salt of *o*-sulphonchloroamidobenzoic acid, thus:

$$C_6H_4\begin{<}{CO\\SO_2}{>}NCl + 2KOH = CO_2K\cdot C_6H_4\cdot SO_2(OK){:}NCl + H_2O;$$

the latter, when treated with an excess of chlorine, is converted into the corresponding salt of *o*-sulphondichloroamidobenzoic acid, thus:

$$CO_2K\cdot C_6H_4\cdot SO_2(OK){:}NCl + Cl_2 = CO_2K\cdot C_6H_4\cdot SO_2\cdot NCl_2 + KCl.$$

Both of the acids can be liberated from their salts as sparingly soluble crystalline solids on addition of dilute mineral acids.

***205. "The action of heat on α-hydroxycarboxylic acids. Part II. α-Hydroxymargaric acid, α-hydroxypalmitic acid, α-hydroxypentadecylic acid, and α-hydroxymyristic acid." By Henry Rondel Le Sueur.**

When the α-hydroxy-derivatives of margaric, palmitic, pentadecylic, and myristic acids are heated to 270—275°, they decompose with formation of the lactide of the hydroxy-acid and an aldehyde containing one carbon atom less than the original hydroxy-acid, the yield of aldehyde varying between 35 and 50 per cent. of that required by theory. This decomposition is exactly analogous to that undergone by α-hydroxystearic acid when it is heated (*Trans.*, 1904, **85**, 827), and may be represented thus:

$$R\cdot CH(OH)\cdot CO_2H \longrightarrow RCHO + HCO_2H \dashrightarrow CO + H_2O.$$

$$2R\cdot CH(OH)\cdot CO_2H \longrightarrow R\cdot CH\cdot O\cdot CO$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\quad |\qquad\quad |$$
$$\qquad\qquad\qquad\qquad\qquad\qquad OC{-}O{-}CH\cdot R$$

The aldehydes, which are white solids, readily soluble in the ordinary organic solvents, possess all the properties characteristic of aliphatic aldehydes, that is, they form oximes, semicarbazones, hydroxycyanides, and yield the corresponding acids on oxidation with potassium permanganate.

As the yield of aldehyde is a good one, this method is especially applicable to the preparation of these compounds and also for passing from one acid to the next lower member in the same series.

***206. "Studies on optically active carbimides. Part II. The reactions between *l*-menthylcarbimide and alcohols." By Robert Howson Pickard, William Oswald Littlebury, and Allen Neville.**

l-Menthylcarbimide reacts readily with alcohols, and fourteen have been shown to yield *l*-menthylcarbamates, the molecular rotations of the same having an approximately constant value for each solvent. The course of a reaction between the carbimide and an alcohol can be readily followed in the polarimeter. The reaction between ethyl alcohol and the carbimide is bimolecular, the velocity being greatly influenced by the solvent used. When ethyl alcohol is employed as the solvent, the reaction becomes unimolecular, and the velocity constant is approximately proportional to the change of temperature. The velocity constants of the reactions between the carbimide and fourteen alcohols are compared.

***207. "The liberation of tyrosine during tryptic proteolysis. A preliminary communication." By Adrian John Brown and Edmund Theodore Millar.**

A method of directly estimating tyrosine by bromination recently described by James H. Millar (*Trans. Guinness Research Laboratory*, 1903, Vol. I, Part I) appeared likely to furnish a means of measuring the activity of proteolytic change in those cases in which tyrosine is liberated during the breaking down of the protein molecule. An investigation in this direction was therefore commenced by the authors and the following is a summary of the results so far obtained.

(1) J. H. Millar's method of estimating tyrosine by bromination is applicable to the estimation of tyrosine in the presence of proteins and their earlier cleavage products due to enzyme action if suitable, control experiments are employed.

(2) Tyrosine is not a late product of tryptic proteolysis, as is usually supposed; on the contrary, the tyrosine nucleus of a protein is attacked, and the whole of the tyrosine liberated during the first stage of tryptic digestion.

(3) The resistance of the protein tyrosine nucleus to peptic hydrolysis is confirmed.

(4) Attention is called to the similarity of Emil Fischer and E. Abderhalden's recent observations on the actions of tryptic and peptic enzymes on polypeptides containing a tyrosine nucleus (*Zeit. physiol. Chem*, 1905, **46**, 52) to the authors' observations on the actions of the same enzymes on proteins containing a tyrosine nucleus.

(5) The authors' investigations appear to indicate a trustworthy means of differentiating enzymes of a peptic from those of a tryptic nature, and may assist in throwing some light on the confused state of knowledge with regard to the existence of a tyrosine nucleus in the different albumoses resulting from peptic and tryptic proteolysis.

208. "Ethyl piperonylacetate." By William Henry Perkin, jun., and Robert Robinson.

When piperonylic acid, $CH_2O_2{:}C_6H_3{\cdot}CO_2H$, is treated with phosphorus pentachloride, it is converted into *piperonyl chloride*, $CH_2O_2{:}C_6H_3{\cdot}COCl$, a colourless, crystalline substance which melts at 80° and distils at 155° (25 mm.). This acid chloride (1 mol.) reacts with the sodium derivative of ethyl acetoacetate (2 mols.) yielding the pale yellow crystalline *sodium* derivative of *ethyl piperonylacetoacetate*, $CH_2O_2{:}C_6H_3{\cdot}COCNa(CH_3{\cdot}CO){\cdot}CO_2Et$; the corresponding *cupric* derivative, $(C_{14}H_{13}O_6)_2Cu$, crystallises from toluene in bluish-green plates. *Ethyl piperonylacetoacetate*, obtained from the pure sodium derivative by treatment with acids, is a colourless syrup which is soluble in sodium carbonate and gives a reddish-violet coloration with alcoholic ferric chloride.

When the sodium derivative is treated with ammonia and ammonium chloride (Claisen, *Annalen*, 1896, **291**, 70), it is decomposed with formation of *ethyl piperonylacetate*, $CH_2O_2{:}C_6H_3{\cdot}CO{\cdot}CH_2{\cdot}CO_2Et$, a solid, crystalline substance which melts at 41°, gives a reddish-violet coloration with ferric chloride, and yields a *copper* derivative, $(C_{12}H_{11}O_5)_2Cu$.

The authors wish to reserve, for a short time, the investigation of these new compounds.

209. "The action of ultra-violet light on moist and dried mixtures of carbon monoxide and oxygen." By Samuel Chadwick, John Edwin Ramsbottom, and David Leonard Chapman.

The chemical effects produced by the passage of the electric discharge through gases are the result of at least three distinct causes, namely, (1) the cathode rays, (2) ultra-violet light, (3) catalytic action of the electrode and in particular the cathode. Ultra-violet light alone has been shown by Lenard to act on oxygen with the formation of ozone. The authors working with a quartz mercury lamp, with which three per cent. of ozone could be produced from pure oxygen, have obtained the following results. A mixture of equal volumes of carbon monoxide and oxygen dried with sulphuric acid and submitted

to the action of ultra-violet light, contracted at first slowly, and then more rapidly, until a maximum rate of decrease of volume was attained. The rate of contraction then gradually decreased, and finally became so slow that the experiment was stopped, and the composition of the gases found by analysis. It was ascertained that 22·95 per cent. of the carbon monoxide had been converted into carbon dioxide, and that 39·63 per cent. of the original oxygen had been changed into ozone.

A mixture of equal volumes of carbon monoxide and oxygen dried with phosphoric oxide behaved in almost the same way as the mixture which had been dried with sulphuric acid alone. When the contraction had reached approximately the same value as in the last experiment, it was found on analysis that 19·42 per cent. of the total carbon monoxide had been converted into carbon dioxide, 37·48 per cent. of the original oxygen being this time changed into ozone.

With the same mixture saturated with water vapour at 16°, the result was markedly different. The rate of contraction was practically uniform throughout the experiment, and this rate was less than half the value of the maximum rate with the dried mixture. When the total contraction had reached almost the same value as in the two previous experiments, it was found that 53·2 per cent. of the carbon monoxide had been converted into carbon dioxide, and only 2·6 per cent. of the oxygen into ozone.

If the first action of the ultra-violet light is conceived as consisting of a breaking up of the oxygen molecules into atoms, the atoms of oxygen thus formed prefer to combine with the molecules of carbon monoxide when the gases are moist, but with oxygen molecules when the gases are dry. In the present case, the rate of chemical change, measured by the contraction, is not accelerated by the presence of moisture, but the course of the reaction is determined by the hygroscopic condition of the mixture.

210. "Benzoyl derivatives of salicylamide."
By Arthur Walsh Titherley.

Doubt has been thrown by Einhorn and Auwers on the formula $BzO{\cdot}C_6H_4{\cdot}C(OH){:}NH$, attributed by Titherley and Hicks (*Trans.*, 1905, **87**, 1207) to the stable benzoylsalicylamide (m. p. 208°) originally obtained by Gerhardt and Chiozza (*Ann. Chim. Phys.*, 1856, **46**, 139), and which is produced by rearrangement even at 15° from the labile *O*-benzoylsalicylamide, $BzO{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$ (m. p. 144°), recently isolated by Titherley and Hicks.

Einhorn, in conjunction with Schupp (*Ber.*, 1905, **38**, 2792), and also with Haas (*Ber.*, 1905, **38**, 3628), considers the stable substance to be the

N-benzoyl derivative, $OH \cdot C_6H_4 \cdot CO \cdot NHBz$, as also does Auwers (*Ber.*, 1905, **38**, 3256), who regards the rearrangement as due to the wandering of the benzoyl group from O to N: $BzO \cdot C_6H_4 \cdot CO \cdot NH_2$ (labile, m. p. 144°) $\longrightarrow$ $OH \cdot C_6H_4 \cdot CO \cdot NHBz$ (stable, m. p. 208°). The change would be analogous to that which takes place when attempts are made to isolate *O*-acyl-*o*-hydroxy-aromatic amines of the type $AcO \cdot C_6H_4 \cdot NHR$ and $AcO \cdot C_6H_4 \cdot CH_2 \cdot NHR$, where rearrangement occurs leading to the production of the *N*-acyl derivatives.

If the *N*-benzoyl formula be ascribed to the substance (m. p. 208°), it must be looked on as possessing anomalous properties; thus, it gives no ferric chloride reaction, is not decomposed by ammonia, like $C_6H_5 \cdot CO \cdot NHBz$, and in other ways does not behave like an *N*-benzoyl derivative. Further, on heating with phosphorus oxychloride, it yields benzoylsalicylnitrile, which favours the *O*-benzoyl formula, thus:

$$BzO \cdot C_6H_4 \cdot C(OH) : NH \longrightarrow BzO \cdot C_6H_4 \cdot CN + H_2O.$$

Further investigations are proceeding with a view to elucidating the correct constitution of the substance.

211. "The constitution and colour of diazo- and azo-compounds." By Arthur Hantzsch.

In the August number of the *Transactions*, Armstrong and Robertson published a paper under the title: "The Significance of Optical Properties as Connoting Structure" (pp. 1272—1297), in which my theory of the stereochemistry of the diazo-compounds is criticised, and the remarkable conclusion expressed, that "the Hantzsch-Werner hypothesis" (in reality, so far as concerns the diazo-compounds, the "Hantzsch hypothesis"), "besides being an intangible and improbable conception, is unnecessary in fact."

If such an expression of opinion were correct, it would certainly not be without some significance, whilst the same holds conversely if such a view is shown to be incorrect, or at all events founded on a false basis. Since the latter is the case, it will be readily admitted that such a refutation ought also to find a place in the Society's publications.

The facts on which I venture to base this statement are simply the various researches on the subject, which I have published in the pages of the *Berichte der deutschen chemischen Gesellschaft*, a synopsis of which is to be found in a small published brochure, "*Diazoverbindungen*," F. Enke, Stuttgart, 1902.

The delay in replying is due to the fact that I only became acquainted with Armstrong and Robertson's work at the beginning of November.

Armstrong and Robertson proceed from the assertion that "all compounds containing the group Ph·N:N·X must be coloured" to the conclusion (p. 1280) that "all compounds of the type Ph·N:N·X should be coloured, and consequently only coloured diazo-compounds can be represented by such a formula. The formulæ assigned by Hantzsch to the so-called normal and *iso*diazotates are at once ruled out of consideration by this argument, as both these classes of compounds are colourless"; in other words, the latter do not correspond to the structural formula Ph·N:N·OK.

It must first be observed that all chemists from Kekulé onwards, who have worked on diazo-compounds, must therefore have employed an incorrect formula, for they all, before as well as after the discovery of diazo-isomerism, accepted the formula Ph·N:N·OK for at least one of the two isomerides. But apart from this, Armstrong and Robertson's assertion can readily be shown to stand in contradiction to the facts, for according to their views the nature of an azo-compound as such is established by the fact that the compound is a coloured substance, and, conversely, a particular substance cannot be an azo-derivative because it is colourless. Such a conclusion has up to the present proved totally unacceptable, for Thiele's well-known extensive researches (*Annalen*, 1896, **290**, 1) have shown that *both coloured and colourless azo-compounds exist* in the aliphatic series, for instance, the deep red azo-dicarboxylic ester, $CO_2R{\cdot}N{:}N{\cdot}CO_2R$, and the colourless azo-*iso*butyric acid derivatives, $CRMe_2{\cdot}N{:}N{\cdot}CRMe_2$. When Armstrong and Robertson proceed "being colourless, the diazo-salts cannot be formulated as diazene (–N:N–) compounds" (p. 1280), it is certainly logical to assert "that being colourless these so-called azo-compounds of the aliphatic series cannot be compounds of the type –C·N:N·C."

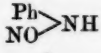
So long, therefore, as Armstrong and Robertson do not offer any explanation of these facts, or substitute other constitutional formulæ for these colourless compounds, regarded generally as azo-derivatives, just so long will their conclusion, namely, "that diazotates being colourless cannot have the ordinary formula Ph·N:N·OK," remain unacceptable. But amongst the diazobenzene derivatives there also exist true chemical compounds containing the group Ph·N:N·X; these, therefore, according to Armstrong and Robertson, must be coloured, but in reality they are colourless. For example, amongst the nitro-*iso*diazobenzene esters we have the nitro-diazo-ester, $NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}O{\cdot}CH_3$ (von Pechmann, *Ber.*, 1894, **27**, 672), which, to quote the author's description, "in the pure state is perfectly colourless." Here again it is necessary for them to replace the formula by a more suitable one, or their conclusions must necessarily be regarded as incorrect.

According to their view, "the normal diazotates must perforce be regarded as *diazonium derivatives*"; I do not consider it necessary to disprove this statement, and will content myself by pointing out that even Bamberger has given up the diazonium formula for the labile diazotates (*Annalen*, 1900, **313**, 98), and that his last attempt to rehabilitate it (*Ber.*, 1903, **36**, 4054) has been shown to be unwarranted (*Ber.*, 1904, **37**, 1084).

As regards the proposed formulæ for the *iso*diazotates (p. 1282), Ph·N—N·K or Ph·NK·NO, the same remarks apply. I discussed

these formulæ at length some considerable time ago, and showed them to be unsatisfactory, and they have, as a matter of fact, been abandoned by all chemists who have studied experimentally the chemical behaviour of these substances. The two formulæ of Armstrong and Robertson also stand in contradiction to the fact that the previously-mentioned diazo-ester, $NO_2 \cdot C_6H_4 \cdot N{:}N \cdot OCH_3$, can be obtained from the *iso*diazotate, so that in consequence the existence of a third hydroxyl form must be accepted. These hydroxyl compounds (Ph·N:N·OH) are not imaginary tautomeric substances, but real, definite, chemical compounds, for in conjunction with W. Pohl (*Ber.*, 1902, **35**, 2964) I have shown that from the colourless *iso*diazotates there is formed, primarily, the free *iso*-(anti)diazohydroxide as a colourless, true acid, the general behaviour of which certainly indicates the presence of an (OH) group.

Armstrong and Robertson must therefore suggest another "hydroxyl formula" in place of Ph·N:N·OH, and the fact cannot be too plainly pointed out that in accepting the nitrosoamine formula for the *iso*diazotates they again immediately stand in contradiction to their fundamental doctrine on the relation of colour to constitution, for, as is well known, most of the true secondary nitrosoamines, and nitrosoamine derivatives, are coloured. The indifferent primary nitrosoamines obtained as *pseudo*-acids by W. Pohl and myself through intramolecular change of the diazohydroxides are also coloured, although as a logical consequence from Armstrong and Robertson's nitrosoamine formula (that is, absence of the group Ph·N:N) these *iso*diazotates should be colourless if they were really nitrosoamine salts. As is seen from the three formulæ:



1.

2.

3.

by simple substitution of K for H or R, we obtain from the *coloured* substances (1) and (2) a *colourless* potassium salt (3), a result

which is again incompatible with Armstrong and Robertson's theory.*

The whole of Armstrong and Robertson's views on the normal diazosulphonates and diazocyanides are quite incorrect. They state (p. 1281) "the action of sulphite may be supposed to involve in the first place the formation of a diazonium sulphonate, $\overset{\cdots}{\underset{\cdots}{R\cdot N\cdot SO_3K}}$," and, so far as I can understand, also put forward the formula $Ph\cdot NH\cdot SO_2K\cdot NOH$. The latter formula is impossible, because most diazosulphonates correspond to the formula $Ph\cdot N_2\cdot SO_3K$; that is, to one containing no water. The diazonium formula itself stands in contradiction to their theory, for if the appearance of colour denotes a change in constitution, and if all the sulphonates of colourless metals (namely, those of silver and mercury) are colourless, why is it that the diazonium sulphonates formed from the colourless diazonium and sulphonic acid components possess an intense orange colour? From the very fact that the labile equally with the stable sulphonates are coloured, they must both be azo-compounds, $Ph\cdot N{:}N\cdot SO_3K$.

The statement that "the so-called *syn*-compound sulphonates and cyanides may well be simple equilibrated mixtures of diazonium cyanides and sulphonates with the stable *anti*-compounds" (p. 1283) is controverted by the facts, for all the normal diazocyanides exhibit analogous behaviour with water and cuprous oxide, but in a manner quite different from that of the *iso*diazocyanides. Further, as regards their colour and constitution, the labile *syn*-diazocyanides and diazosulphonates are always more intensely coloured than the stable *anti*-forms. All diazonium sulphonates are colourless, and all diazosulphonates should be colourless; so that Armstrong and Robertson's view leads to the remarkable result that, by the addition of a colourless to a coloured substance, the colour intensity of the resulting mixture is increased—certainly the greatest *contradictio in adjecto*. In addition, Armstrong and Robertson have not sufficiently taken into consideration the fact that the labile cyanides are distinct chemical compounds possessing definite unchangeable properties, that is, they are not chemical mixtures. The explanation of the change of the *syn*- into the *anti*-form (p. 1281) is impossible by reason of the assumption that an addition of the elements of water takes place, with a subsequent

* The reference to Dobbie and Tinkler's work (*Trans.*, 1905, **85**, 277; and Proc., 1905, **21**, 75), namely, "that the salt $NO_2\cdot C_6H_4\cdot N_2\cdot OK$, in respect to its absorption spectrum, behaves as a nitrosoamine, and not as a diazo-salt," stands in marked contradiction to all its chemical properties. This being so, too much weight cannot be attached to this evidence until it has been ascertained, for example, how the isomeric esters $NO_2\cdot C_6H_4N{:}N\cdot O\cdot CH_3$ and $NO_2\cdot C_6H_4N(CH_2)\cdot NO$ behave under similar conditions, a point which the above-named chemists, at my request, have most kindly promised to investigate.

splitting off of the same elements, for in reality many *syn*-sulphonates and very many *syn*-cyanides isomerise in the solid state or in anhydrous solvents.

In short, therefore, the whole of Armstrong and Robertson's conceptions with respect to labile diazo-isomerism are impossible, and their remark that my "*syn-anti*-conception is based upon a false use of the principle of analogy" will certainly be considered as more applicable to their own untenable theories, according to which "the stereochemistry of the diazo-compounds is unnecessary in fact."

With such statements as "in the case of the diazosulphonates, it is clear that they differ essentially in type," put forward without the support of a single experimental fact, equally without any theoretical explanation, discussion is out of the question and, in fact, would be superfluous.

It is unfortunately necessary for me to make an emphatic protest in reference to Armstrong and Robertson's remarks (p. 1280) on the small value which ought to be placed on the analytical results of the labile diazo-isomerides. One has the right to expect that before such statements are made reflecting on the accuracy of the work in question, the greatest care has been taken to verify the facts. That such a sweeping assertion is altogether unwarranted, will, I think, be admitted from a consideration of the following points:

(1) *Labile Diazotates.*—The labile diazotates certainly always contain small quantities of alkali (*Ber.*, 1901, **34**, 2159; 1902, **35**, 2969) or water of crystallisation (*Ber.*, 1895, **28**, 2006; 1896, **29**, 1077), but in the form of their crystalline salts they have been obtained quite pure, so that no chemist who has worked on the subject, from Kekulé onwards to Bamberger, has ever seriously questioned the accuracy of the empirical formula ArN_2OK for the diazotates.

(2) *Labile Diazosulphonates.*—The numerous concordant analyses on these substances (*Ber.*, 1894, **27**, 3529; 1897, 30, 76, 80—81) prove undoubtedly the accuracy of the formula PhN_2SO_3K for this substance. It is true there is generally present a small quantity of the anti-salt, formed by spontaneous isomerism of the *syn*-derivative, but this certainly does not come into question as affecting the accuracy of the formula or as regards the facts of the isomerism.

(3) *Labile Diazocyanides.*—The fact must be emphasised that many of these compounds can without difficulty be very readily obtained and isolated in a pure state (*Ber.*, 1896, **29**, 666; 1897, 30, 2530), so that their constitution as chemically individual substances cannot be doubted. They are not to be regarded, therefore, as "eminently unstable" and "impure," as Armstrong and Robertson assert. As a matter of fact, some of the *syn*-derivatives are so stable as to be only convertible with difficulty into the more stable isomeric *anti*-form.

The undoubted existence of these two classes of compounds (the representatives of the stereo-isomeric azo-compounds), which Armstrong and Robertson do not admit, provides therefore the strongest proof for my stereochemical theory of the diazo-derivatives, a theory supported by a large mass of experimental evidence, in connection with which the theoretical signification has always been carefully pointed out. The reflection by Armstrong and Robertson on the accuracy of this work is altogether unwarranted, and with a thorough knowledge of the subject, it is impossible for me to understand how such assertions could be made.

I am forced to conclude that they have not thoroughly informed themselves in respect to my experimental investigations. Above all, I have to deplore that the numerous exact analytical results already published should thus be brought into discredit, and the stereochemistry of the diazo-derivatives founded on them regarded as "unnecessary in fact"; to be replaced by a view with which the facts, indeed the principle itself, stand in direct contradiction.

In reply to the statement that "I am opposed in principle to conclusions based on optical evidence" (*Ber.*, 1899, **32**, 3149), it is only necessary for me to say that such conclusions in regard to constitution are not warranted from a mere consideration of the optical properties, more especially when these stand in contradiction to the general chemical behaviour of the substance.

It is certainly a very great surprise to me that such a statement should be brought forward, for I have always regarded the physico-chemical behaviour of the substance as of very great importance, and especially in relation to the colour of substances as denoting their constitution. Thus, some eighteen years ago, in conjunction with Hermann (*Ber.*, 1887, **20**, 2801), I was one of the first to draw attention to the relation between colour and constitution in the case of desmotropic substances, and recently, as a result of my researches on pseudo-acids, I have been able to show experimentally that the appearance of colour in the formation of coloured alkali salts from hydrogen compounds is due to an intramolecular change taking place in the position of a hydrogen atom. I intend publishing shortly an account of several researches dealing with the relation of colour to constitution, and in particular establishing the quinonoid structure for nitrophenols, a theory first put forward by Armstrong on very slender experimental evidence, and certainly not accepted by a large number of chemists at the present time.

Summarising, it is my firm conviction that the colour of substances is one of the most important criteria in the characterisation of their constitution, but at the same time it is also one of the most delicate and subtle. Unfortunately, it is in so very many cases quite im-

possible to explain the origin of the colour, or to account for the remarkable phenomena by structural formulæ. It is only necessary to recall the existence of the coloured fulvene, of the coloured diphenylene-ethylene derivatives $\left(\begin{matrix}C_6H_4\\C_6H_4\end{matrix}\!>\!C{:}CR_2\right)$ on the one hand, and the colourless polyacetylene on the other; of the coloured derivatives of diethoxynaphthostilbene, dibenzoylethylene, and benzaldesoxybenzoin compared with their colourless isomeric modifications.

In short, as pertaining in particular to the azo- and diazo-derivatives considered in the light of their chemical and physical properties, there exist both *coloured* and *colourless* azo- and diazo-compounds, the cause of which colour is unknown, and which, although representable by Baeyer's valency formulæ (–Ph·N:NR colourless, Ph·N≈≈N·R coloured), remain still unexplained by any rational structural formulæ. Above all it should not be overlooked that a sharp line of demarcation between coloured and colourless substances does not exist either theoretically or practically; for the same complex appears in an intensely-coloured, a pale-coloured, or a colourless substance, according to the nature of the groups associated with it. Thus, in the case of the aromatic azo-complex Ph·N:N, when this is attached to nitrogen the colour-intensity of the products is less than when it is attached to carbon (thus, Ph·N:N·NH·C_6H_5 possesses a lighter yellow colour than Ph·N:N·CN or Ph·N:N·Ph). It is therefore comprehensible that when the same complex is attached to oxygen (as in the diazotates Ph·N:N·OR) we have a colourless substance formed, more especially as the diazo-compounds containing the group RO·N:N·OR (for example, hyponitrous acid, salts, and esters) are also colourless.

We have accordingly in the following series of colour intensities:

Ph·N:N·OR	Ph·N:N·NHR	Ph·N:N·CN
Colourless.	Pale-coloured.	Intensely-coloured.

a collection of facts which we cannot explain or represent satisfactorily by structural formulæ.

The change of condition from the coloured to the colourless state in azo-compounds is bound up with, but not, however, altogether dependent on, the known structural and stereochemical isomerism of the diazo-derivative, that is, presence or absence of colour is not definitely decided by such isomerism, for whilst both classes of the stereoisomeric diazotates are colourless, both those of the stereoisomeric diazosulphonates and diazocyanides are coloured. Since Armstrong and Robertson's views and formulæ are quite untenable, the older structural and stereochemical formulæ indicate now, as before, the best and most accurate representation of the facts concerning the diazo-compounds.

212. "Note on the incandescent mantle as a catalyst and its application to gas analysis." By John Ernest Mason and John Wilson.

The method described by Lewes (*Chem. News*, 1905, **91**, 61) for demonstrating the incandescence of the ordinary gas mantle in a cold mixture of coal gas and air may also be employed with a mixture of ammonia vapour and air. The authors described a modification for showing the incandescence of the mantle in an unburnt mixture of alcohol vapour and air. Although less effective, the mantle may be used as a substitute for platinised asbestos in the ordinary lecture experiments for preparing formaldehyde from methyl alcohol vapour and air, and sulphur trioxide from sulphur dioxide and oxygen.

Fragments of mantle in a hard glass or preferably quartz tube may be used in place of palladium or palladium-asbestos, for the estimation of hydrogen and carbon monoxide in gas analysis by combustion with excess of air or oxygen. Methane and mixtures of methane and hydrogen may be estimated similarly by passing these gases mixed with excess of oxygen over fragments of mantle heated in a quartz tube, and measuring the contraction after combustion and subsequent treatment with caustic potash solution. The results agree well with those obtained by the customary explosion methods. Good results may also be obtained by passing the gases mixed with oxygen over asbestos heated in a small quartz tube. Hydrogen, and less readily methane, may be estimated by passing the gas mixed with oxygen through narrow tubes of heated Jena glass alone.

213. "The influence of certain amphoteric electrolytes on amylolytic action." By John Simpson Ford and John Monteath Guthrie.

An investigation of the influence of asparagine, glycine, and α-alanine on amylolytic action has led to the following conclusions:

(1) Asparagine and the amino-acids mentioned have no specific influence in augmenting the action of amylase; the apparent augmentation of action sometimes obtained by the addition of these amphoteric substances (or of feeble acids) is due to their neutralising alkaline (or other) impurity in the starch or enzyme solution.

(2) Normal amylolytic action takes place in neutral solution. In the plant substance, this neutrality is brought about by equilibrium between the basic and acid products present.

(3) Until the conditions influencing the action of enzymes are more fully established, it is inadvisable to formulate mathematical laws as to the kinetics of enzymic hydrolyses.

(4) Purified soluble starch has the properties of an extremely feeble acid; it is capable of yielding negative ions under the influence of strongly positive ones.

214. "The estimation of picric acid additive compounds." By Frank Sturdy Sinnatt.

The method of Knecht and Hibbert (*Ber.*, 1903, **36**, 1549) for the estimation of picric acid by means of titanous chloride has been found to be applicable to other picrates, and also to picric acid additive compounds.

Twenty-five c.c. of a solution of 0·200 gram of naphthalene picrate in 250 c.c. of alcohol were titrated with titanous chloride, and gave 99·49 per cent. of naphthalene picrate. Pyridine and strychnine picrates yielded 100·19 and 99·69 per cent. respectively.

In many cases it is convenient to dissolve the picrate in hydrochloric acid. The method has been applied to the estimation of naphthalene in coal gas; the naphthalene picrate is separated by the usual process (Colman and Smith, *J. Soc. Chem. Ind.*, 1900, **19**, 128), washed, dissolved in a small volume of alcohol, and titrated with titanous chloride. If a standard solution of picric acid is used in the wash-bottles, the filtrate and washings may also be titrated. The results compare with those obtained by Colman and Smith's method. The estimation of naphthalene and the applications of the titanous chloride process to other picric acid additive compounds are being continued, and the results will be embodied in a further communication.

215. "Silver dioxide and silver peroxynitrate." By Edwin Roy Watson.

A black, crystalline product, obtained at the anode during the electrolysis of an aqueous silver nitrate solution, was considered by Ritter to be silver dioxide, Ag_2O_2 (*Gehlen's Neues J.*, 1804, **3**, 561). Later investigations showed that it could not be regarded as silver dioxide, and a variety of conflicting formulæ have been proposed.

The author has electrolysed aqueous silver nitrate with different current strengths and densities and with solutions of varying concentrations, and has analysed the product formed at the anode in order to see whether this should be regarded as a definite chemical compound or as a mixture, the composition of which varies with different conditions. It was concluded that the product was a definite chemical compound, and that its composition was correctly represented by Sûlc's empirical formula $Ag_7O_{11}N$. The substance is easily decom-

posed by heat or when left in contact with water or organic matter, such as filter-paper, and to this cause must be attributed the divergent results of the earlier investigators.

This compound, silver peroxynitrate, as it has been termed by Tanatar, on boiling with water decomposes in accordance with the equation $Ag_7O_{11}N = AgNO_3 + 3Ag_2O_2 + O_2$.

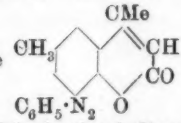
Silver dioxide is a greyish-black powder (sp. gr. 7·44), which may be heated to 100° without decomposition. At higher temperatures it gently decomposes into its elements. It dissolves in hot dilute sulphuric acid in accordance with the equation $2Ag_2O_2 + H_2SO_4 = 2Ag_2SO_4 + 2H_2O + O_2$.

Its behaviour with ammonia is noteworthy, and may be represented in the following manner: $6Ag_2O_2 + 2NH_3 = 3Ag_4O_3 + N_2 + 3H_2O$, so that the compound in solution must be regarded as a polyvalent silver compound, probably mAg_4O_3,nNH_3.

The dioxide of silver and silver peroxynitrate both dissolve in cold concentrated nitric acid with the production of an intensely brown solution, the colour of which gradually fades even at the ordinary temperature and much more rapidly on warming. The rate of decomposition of the compound is proportional to its concentration in the solution, a fact which makes it impossible to give to the compound the simple formula $Ag(NO_3)_2$. The formulæ $Ag_4(NO_3)_8$ and $Ag_2(NO_4)_2$ are, however, possible.

216. "The constitution of *o*-hydroxyazo-compounds. Preparation of benzeneazodimethylcoumarin." By John Theodore Hewitt and Herbert Victor Mitchell.

The authors have hydrolysed the 4 : 6-dimethylcoumarin described by Pechmann and Cohen (*Ber.*, 1884, **17**, 2118), and have coupled the alkaline coumarinate so obtained with phenyldiazonium chloride and the three nitrophenyldiazonium salts.

The alkaline azocoumarinates so obtained are highly coloured, varying in shade from red to violet. On acidification, light-coloured anhydrides of the type  are precipitated.

This instantaneous dehydration indicates the existence of a ready-formed hydroxyl group, even in the *o*-hydroxyazo-series.

Benzeneazo-4 : 6-dimethylcoumarin melts at 199—200°; the *o*-, *m*-, and *p*-nitrobenzeneazo-4 : 6-dimethylcoumarins melt at 240—250° (with decomposition), 212°, and 229° respectively, these melting points being corrected.

217. "Caro's permonosulphuric acid." By Thomas Slater Price.

Hitherto it has not been possible to decide between the formulæ H_2SO_5 and $H_2S_2O_9$ for Caro's permonosulphuric acid. The decision could readily be made if a pure salt, for example, the potassium salt, could be obtained. The simplest method would be to heat a weighed quantity of the salt and determine the weight of potassium sulphate left; this weight would depend on whether the formula was $KHSO_5$ or $K_2S_2O_9$.

The author has not yet succeeded in preparing the pure potassium salt, but a mixture has been obtained containing the potassium salts of sulphuric, permonosulphuric, and perdisulphuric acids, and also potassium hydrogen sulphate. It was found possible to determine the amounts of each of the constituents present, and thus calculate the weight of potassium sulphate which would be left on heating up a known weight of the mixture; this could then be compared with the actual weight found. The results obtained point to the formula H_2SO_5 as the correct one.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Alsina, Fernando. Nouvelles orientations scientifiques. Ouvrage traduit du catalan par J. Pin y Soler. pp. 165. ill. Paris 1905. (*Recd.* 4/12/05.) From the Author.

Bagshaw, Walter. Elementary photo-micrography. pp. 68. ill. London 1902. (*Recd.* 22/11/05.) From the Author.

Board of Agriculture. Report on the results of investigations into Cheddar cheese-making, carried out on behalf of the Bath and West and Southern Counties Society in the years 1891—98, by F. J. Lloyd. pp. 251. ill. London 1899. (*Recd.* 22/11/05.) From F. J. Lloyd, Esq.

—— Report on the results of investigations into cider-making, carried out on behalf of the Bath and West and Southern Counties Society in the years 1893—1902, by F. J. Lloyd. pp. xii + 145. ill. London 1903. (*Recd.* 22/11/05.) From F. J. Lloyd, Esq.

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II. *By Purchase.*

Baumé, Antoine. Chymie expérimentale et raisonnée. 3 volumes. pp. clx + 482, 671, 704. ill. Paris 1773. (*Recd.* 18/11/05.)

Cain, John Cannell, and Thorpe, Jocelyn Field. The synthetic dyestuffs and the intermediate products from which they are derived. pp. xiv + 405. ill. London 1905. (*Recd.* 23/11/05.)

At the next Ordinary Meeting, on **Thursday**, December **21st**, 1905, at **8.30** p.m., the following papers will be communicated:

"The relation of position isomerism to optical activity. Part V. The rotation of the menthyl esters of the isomeric dibromobenzoic acids." By J. B. Cohen and I. H. Zortman.

"Azo-derivatives from α-naphthomethylcoumarin." By J. T. Hewitt and H. V. Mitchell.

"The supposed identity of dihydrolaurolene and of dihydro*iso*-laurolene with 1 : 1-dimethylhexahydrobenzene." By A. W. Crossley and N. Renouf.

"The slow combustion of carbon disulphide." By N. Smith.

"The diazo-derivatives of 1 : 5- and 1 : 8-benzenesulphonylnaphthylenediamines." By G. T. Morgan and F. M. G. Micklethwait.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 4/1/06

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 21. No. 302.

Thursday, December 21st, 1905, at 8.30 p.m. Professor R. MELDOLA, F.R.S., President, in the Chair.

Messrs. P. W. Robertson, Arthur Slator, J. I. Scott, and E. Towyn Jones were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

Thos. Going Stoney Bogue, 5, Kenilworth Square, Dublin.
Stephen Lewis Courtauld, B.A., Bocking Place, Braintree.
Henry Carlyle Irving, B.A., 14, Heath Hurst Road, Hampstead, N.W.
John McDowall, Girdstingwood, Kirkcudbright, Scotland.
John Parkin, M.A., Blaithwaite, Carlisle.
William Hughes Perkins, B.Sc., Harpur Hill, near Buxton.
Philip Foale Rowsell, Nutbrook, Exmouth.
John William Yates, B.Sc., 71, North Street, Hugglescote, near Leicester.

A certificate has been authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of :

Hardolph Wastenays, of Brisbane, Queensland.

Of the following papers, those marked * were read :

***218. "Azo-derivatives from methyl-α-naphthocoumarin." By John Theodore Hewitt and Herbert Victor Mitchell.**

The methyl-α-naphthocoumarin, obtained by the condensation of α-naphthol and ethyl acetoacetate, when dissolved in hot caustic alkalis, yields alkali coumarinates, and if these solutions are cooled and treated with the solution of a diazonium salt, coupling takes place in the usual manner. On acidifying the solution, the corresponding azocoumarin is precipitated, and in none of the four cases examined has the formation of an azocoumarinic acid been observed.

The following substances have been prepared: *benzeneazomethylnaphthocoumarin* (m. p. 207°); o-*nitrobenzeneazomethyl naphthocoumarin* (m. p. 268°); m-*nitrobenzeneazomethylnaphthocoumarin* (m. p. 239°); p-*nitrobenzeneazomethylnaphthocoumarin* (m. p. 270—271°). The last of these compounds is remarkable in giving an intense blue coloration in alkaline solution, the alkaline salts derived from the other compounds being orange or red in aqueous solution.

***219. "The preparation and reactions of benzoyl nitrate." By Francis Ernest Francis.**

Lachowicz showed (*Ber.*, 1884, **17**, 1281) that when benzoyl chloride or other chlorides of the mono- and di-basic organic acids interact with silver or other metallic nitrates, decomposition into oxides of nitrogen and the corresponding organic anhydrides takes place.

If, however, the interaction of benzoyl chloride with silver nitrate is effected at much lower temperatures, oxides of nitrogen are not evolved and benzoyl nitrate is formed:

$$C_6H_5\cdot COCl + Ag\cdot O\cdot NO_2 = C_6H_5\cdot CO\cdot O\cdot NO_2 + AgCl.$$

The product is a light yellow oil which, if carefully warmed, decomposes quantitatively into benzoic anhydride and oxides of nitrogen, but if heated with a free flame this change sets in with explosive violence, the yield of anhydride being much diminished.

Benzoyl nitrate is very rapidly attacked by moisture with the formation of benzoic and nitric acids. When kept at a low temperature either by itself or dissolved in an inert solvent, an interesting change into *m*-nitrobenzoic acid takes place without the formation of either the *o*- or *p*-acid.

Between 0° and −15°, ethyl alcohol and the nitrate give ethyl nitrate, benzene and toluene are converted into their mononitro-derivatives, and phenetole and phenol undergo nitration quantitatively,

the product from the former being apparently *o*-nitrophenetole. Methylaniline is nearly quantitatively converted into phenylmethylnitramine, and in all these reactions benzoic acid is simultaneously formed. Aniline, however, gives aniline nitrate and benzanilide. From these observations, it seems probable that benzoyl nitrate will prove to be generally applicable in effecting nitration at low temperatures and in the absence of water.

***220. "The supposed identity of dihydrolaurolene and of dihydro*iso*laurolene with 1 : 1-dimethylhexahydrobenzene." By Arthur William Crossley and Nora Renouf.**

The hydrocarbons dihydrolaurolene and dihydro*iso*laurolene have been prepared according to the directions given by Zelinsky and Lepeschkin (*Annalen*, 1901, **319**, 303) and their properties carefully compared with those of 1 : 1-dimethylhexahydrobenzene (*Trans.*, 1905, **87**, 1488). The above-mentioned authors supposed that these three substances were one and the same, but this is not so, for neither dihydrolaurolene nor dihydro*iso*laurolene is identical with 1 : 1-dimethylhexahydrobenzene.

The constitution of dihydrolaurolene is still doubtful, but dihydro*iso*laurolene has been proved conclusively to be a pentamethylene derivative and is 1 : 1 : 2-trimethyl*cyclo*pentane.

***221. "The diazo-derivatives of 1 : 5- and 1 : 8-benzenesulphonylnaphthylenediamines." By Gilbert Thomas Morgan and Frances Mary Gore Micklethwait:**

The behaviour of the benzenesulphonyl derivatives of the 1 : 5- and 1 : 8-naphthylenediamines towards nitrous acid has been studied in order to ascertain whether these acylated heteronucleal diamines are capable of yielding diazoimides, and if so to compare the products with the reactive yellow arylsulphonyl*para*diazoimides and the inert colourless acyl*ortho*diazoimides.

Benzenesulphonyl-1 : 8-*naphthylenediamine* (m. p. 166°), obtained by reducing *benzenesulphonyl*-8-*nitro-a-naphthylamine* (m. p. 194°), yields a soluble diazonium salt which, by the action of aqueous sodium acetate, gives rise to *benzenesulphonyl*-1 : 8-*naphthylenediazoimide*,

$$C_{10}H_6{:}[N_2]{\cdot}SO_2{\cdot}C_6H_5;$$

this product is a well-defined, crystalline, yellow diazoanhydride comparable in every respect with the *para*diazoimides already described by the authors.

This result indicates that the property of yielding these coloured diazoimides is not confined to the *p*-diamine series, and that the

characteristic physical and chemical properties of the products do not necessarily arise from the possession of a *para*quinonoid configuration.

as-*Benzenesulphonyl*-N-*methyl*-1 : 8-*naphthylenediamine* and *benzenesulphonyl*-1 : 5-*naphthylenediamine* furnish diazonium salts which are not appreciably affected by aqueous sodium acetate.

***222. "Further experiments on a new method of determining molecular weights." By Philip Blackman.**

When working with solvents of high boiling point, the operations (*Trans.*, 1905, **87**, 1474) must be carried out under reduced pressure, this reduction being effected by means of a filter pump.

To prevent ejection of liquid or mixing, due to violent boiling, two bulbs, instead of one, should be introduced into each limb of the inverted U-piece.

Most of the vapours condense in the bulbs; when a considerable quantity has thus collected in the bulbs, the volumes of the solutions in the test-tubes are observed, care being taken that the liquid in the bulbs does not flow back into the test-tubes during the reading. The liquid is then allowed to return into the tubes, the boiling is repeated, and a reading again taken. This process is repeated as often as is convenient.

A condenser should not be used. Instead of platinum wire, broken pieces of glass were employed. The method works best with volatile solvents, such as acetone (b. p. 56·5—57°), alcohol (96 per cent.), and benzene (b. p. 80—82°).

***223. "Studies in fermentation. The chemical dynamics of alcoholic fermentation by yeast." By Arthur Slator.**

The chief results obtained may be summarised as follows:

1. In the study of the rate of alcoholic fermentation, many complications are eliminated by measuring the velocity over very small ranges of the reaction.

2. The change in pressure due to evolution of carbon dioxide is a convenient and sensitive method of measuring this velocity.

3. The rate of fermentation of dextrose is proportional to the concentration of yeast over a wide range of concentrations.

4. The rate is almost independent of the concentration of sugar except in very dilute solutions. The influence of this concentration is never so great that the velocity is proportional to the concentration of the sugar; the reaction is therefore never one of the first order with regard to the sugar.

5. The temperature-coefficient of the reaction is large, and varies with the temperature. $V_{15}/V_5 = 5{\cdot}6$, $V_{40}/V_{30} = 1{\cdot}6$, and intermediate values are obtained between these temperatures. The temperature quotient for 5° from 5° to 40° forms a series of numbers which seem to be characteristic of the enzyme zymase.

6. The initial rates of fermentation of dextrose, lævulose, sucrose, and maltose are in the ratio 1 : 0·92 : 1·05 : 0·9.

7. The temperature-coefficient of the reaction inhibited by "poisons" is the same as that of the original reaction.

8. It is improbable that any but small quantities of sugar go through the intermediate step of lactic acid in fermentation.

9. These results indicate that the reaction which is measured in these experiments is the slow decomposition of a compound produced by the interaction of the enzyme and the sugar.

***224. "Some new platinocyanides."**
By Leonard Angelo Levy and Henry Arnott Sisson.

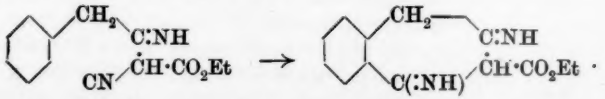
The authors described and gave the results of the analysis of hydrazine and hydroxylamine platinocyanides. These salts form unstable hydrates, which are easily produced by slight changes in temperature. The alteration in the state of hydration is accompanied by striking colour changes.

***225. "An intramolecular change leading to the formation of naphthalene derivatives." By Ernest Francis Joseph Atkinson and Jocelyn Field Thorpe.**

Ethyl sodiocyanoacetate condenses with benzyl cyanide to form *ethyl α-cyano-β-imino-γ-phenyl*-n-*butyrate*,

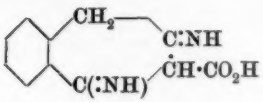
$$Ph{\cdot}CH_2{\cdot}C(:NH){\cdot}CH(CN){\cdot}CO_2Et,$$

a colourless substance crystallising from alcohol in large prisms melting at 125°; its constitution is proved by the fact that on hydrolysis with alcoholic potash it yields phenylacetic and malonic acids. The new imino-ester (I), when treated with an equal weight of cold concentrated sulphuric acid, forms an intense green solution, which, when diluted with water and rendered alkaline with ammonia, gives *ethyl* 1 : 3-*diaminonaphthalene*-2-*carboxylate* (II), forming intense yellow prisms melting at 104°.

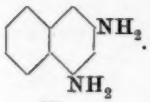


I. II.

The *hydrochloride* forms colourless needles. Ethyl 1 : 3-diaminonaphthalene-2-carboxylate, on treatment with methyl-alcoholic potash, gives a potassium salt from an aqueous solution of which 1 : 3-*diaminonaphthalene-2-carboxylic acid* (III) is precipitated on acidifying with acetic acid.



III.



IV.

The acid forms slightly coloured needles from warm water, which decompose at about 85°, and when heated at this temperature until the evolution of carbon dioxide has ceased are transformed into 1 : 3-naphthylenediamine (IV) which, when recrystallised from dilute alcohol, forms small plates melting at 96°.

The *diacetyl* derivative forms needles from glacial acetic acid melting at 263°.

Discussion.

In reply to questions from Drs. Forster and Morgan, Dr. Thorpe stated that the reaction with cold sulphuric acid proceeded very rapidly and was complete after about one minute, the yield being practically quantitative. Hitherto the yield of ethyl α-cyano-β-imino-γ-phenyl-n-butyrate only amounted to 25 per cent., but by slightly altering the conditions of the experiment it was hoped that this amount would be largely increased. The temperature at which the condensation was carried out greatly influenced the quantity of the condensation product formed.

226. "The relation of position isomerism to optical activity. V. The rotation of the menthyl esters of the isomeric dibromobenzoic acids." By Julius Berend Cohen and Israel Hyman Zortman.

In continuation of previous investigations on this subject (*Trans.*, 1903, **83**, 1213; 1904, **85**, 1262, 1271; 1905, **87**, 1190), the present communication contains an account of certain physical constants, including the molecular rotations of the six isomeric menthyl dibromobenzoates. With the exception of the 2 : 6-ester, the effect on the rotation of the substitution of two bromine atoms is generally less than that of two chlorine atoms, or one chlorine and one bromine, in the same positions. The magnitude of the deviation, beginning with the ester of smallest rotation, is 2 : 6; 2 : 3; 2 : 5; 2 : 4; 3 : 5; 3 : 4;

phenyl. The order is the same as that of the dichloro- and chlorobromo-esters with the exception of the 3 : 4- and 3 : 5-esters, the positions of which in the present case are reversed. The influence of the ortho-bromine atom in depressing the rotation is very clearly indicated in all cases, but most strikingly in that of the 2 : 6-ester, which shows a rotation of $[M]_D^{20°} - 19{\cdot}5°$ compared with the next lowest (2 : 3), which gives $[M]_D^{20°} - 173{\cdot}2°$, or with menthyl benzoate, in which $[M]_D^{20°}$ is $-236{\cdot}3°$.

227. "Some derivatives of naphthoylbenzoic acid and of naphthacenequinone." By Jan Quiller Orchardson and Charles Weizmann.

The authors have investigated a series of condensations which have resulted in the preparation of substitution derivatives of naphthoylbenzoic acid, and from these, by the action of concentrated sulphuric acid, they obtained the corresponding substituted naphthacenequinones.

228. "Ethyl β-naphthoylacetate." By Charles Weizmann and Ernest Basil Falkner.

β-Naphthoic acid was converted into β-naphthoyl chloride, $C_{10}H_7{\cdot}CO{\cdot}Cl$, by treatment with phosphorus pentachloride, and this chloride was then allowed to react with the sodium derivative of ethyl acetoacetate. The *ethyl β-naphthoylacetoacetate*, $\begin{matrix} C_{10}H_7{\cdot}CO \\ CH_3{\cdot}CO \end{matrix}\!\!>\!CH{\cdot}CO_2Et$, melted at 57°, and when digested with ammonia and ammonium chloride yielded *ethyl β-naphthoylacetate*, which melted at 34° and gave rise to a *hydrazone* (m. p. 95°).

229. "Contributions to the chemistry of the amidines. 2-Aminothiazoles and 2-imino-2 : 3-dihydrothiazoles. 2-Iminotetrathiazoles and 2-amino-4 : 5-dihydrothiazoles." By George Young and Samuel Irwin Crookes.

It was shown that the alkylation of amidines belonging to the thiazole group which have one of the nitrogen atoms and the carbon atom of the group –N:C·N:, forming part of a closed chain, whilst the other nitrogen atom lies outside the cyclic nucleus, leads to the formation of derivatives in which the alkyl group is attached to the nitrogen atom of the nucleus, except when the ring is already partially reduced and an aryl group is attached to the nitrogen atom of the side-chain, to which, in this case, the alkyl group becomes attached. Methylation of an amidine takes place by addition of methyl iodide and subsequent elimination of the hydrogen haloid.

The following substances were described:

Acetyl-2-anilino-4-methylthiazole, $C_{10}H_9N_2SAc$, forms clusters of soft, white needles (m. p. 114·5°); 2-phenylimino-3 : 4-dimethyl-2 : 3-dihydrothiazole, $\begin{matrix}CH\text{——}S\\ \|\\ CMe\cdot NMe\end{matrix}\!\!>\!C\cdot NPh$, separates in small, white crystals (m. p. 65—66°) and forms a *platinichloride* (m. p. 189—190°). *2-Allylamino-4-methylthiazole*, $\begin{matrix}CH\text{—}S\\ \|\\ CMe\cdot N\end{matrix}\!\!>\!C\cdot NH\cdot C_3H_5$, crystallises in long, white needles (m. p. 40—41°) and forms an *acetyl* derivative (m. p. 36—37°). *2-Allylimino-3 : 4-dimethyl-2 : 3-dihydrothiazole*, $\begin{matrix}CH\text{——}S\\ \|\\ CMe\cdot NMe\end{matrix}\!\!>\!C\cdot N\cdot C_3H_5$, is a slightly red, viscid oil which forms a *hydriodide* (m. p. 116—117°). The *silver* derivative of 2-acetylimino-4-methyl-2 : 3-dihydrothiazole yields, on methylation, 2-acetylimino-3 : 4-dimethyl-2 : 3-dihydrothiazole (m. p. 113°); 2-methylamino-4-methylthiazole (m. p. 64°) yields, on methylation, 2-methylimino-3 : 4-dimethyl-2 : 3-dihydrothiazole hydriodide (m. p. 164°).

2-Phenylimino-5-methyltetrahydrothiazole forms a *silver* derivative decomposing at 130° and an *acetyl* derivative melting at 47°; 2-phenylmethylamino-5-methyl-4 : 5-dihydrothiazole picrate forms soft, yellow needles (m. p. 114—115°); *2-phenylethylamino-5-methyl-4 : 5-dihydrothiazole*, $\begin{matrix}CHMe\cdot S\\ |\\ CH_2\text{—}N\end{matrix}\!\!>\!C\cdot NEtPh$, is oily and forms a *platinichloride* decomposing at 156°.

A similar series of compounds, in which the *p*- and *o*-tolyl groups replace the phenyl group of the foregoing substances, has also been prepared.

When successively oxidised and hydrolysed, the 2-arylalkylamino-5-methyl-4 : 5-dihydrothiazoles yield *β*-methyltaurine, which melts at 284—285°, and the corresponding arylalkylamine.

230. "The action of water on diazo-salts." By John Cannell Cain and George Marshall Norman.

The authors have extended the work already briefly described (*Proc.*, 1905, **21**, 206) to the examination of the diazo-salts from 2 : 4-dibromoaniline and dibromo-*p*-toluidine ($CH_3 : NH_2 : Br : Br = 1 : 4 : 3 : 5$), and in each case were successful in obtaining the corresponding substituted phenols. The results of a series of researches carried out during the past four years by the author and his assistants have been summarised.

231. "Note on the atomic weight of nitrogen." By Alexander Scott.

By the titration of ammonium bromide against silver, the author (*Trans.*, 1901, **79**, 154) obtained results which differed notably from those of Stas, although the values from the chloride seemed to agree somewhat better. These values were:

NH_4Cl	= 53·532 (Stas)	53·516 (Scott)
N	= 14·045 („)	14·029 („)
NH_4Br	= 98·032 („)	97·995 („)
N	= 14·047 („)	14·010 („)

Stas' values for the atomic weight of nitrogen agree with one another, whilst those of the author do not. These values depend, however, on the correctness of the atomic weights taken for chlorine and for bromine, which were assumed to be 35·457 for chlorine and 79·955 for bromine.

By the recent determinations of T. W. Richards and R. C. Wells ("A revision of the atomic weights of sodium and chlorine," 1905), published by the Carnegie Institution of Washington, the want of agreement in the author's values has been completely cleared up and the discrepancy (to an equal extent) transferred to the determinations made by Stas. They prove that Cl = 35·473.

The work of the author was criticised last year by T. W. Richards (*Proc. Amer. Phil. Soc.*, 1904, **43**, 116), who maintained that 14·01 was too low for the atomic weight of nitrogen, and at the end of his paper he states that "It seems probable that the atomic weight of nitrogen is not less than 14·02 and not over 14·04, probably being nearer to the latter value than to the former."

The physical work of Lord Rayleigh and of Leduc on this problem as well as the chemical and physical work of Guye and his co-workers and of R. W. Gray (*Trans.*, 1905, **87**, 1601) all render the conclusions of Richards quite untenable. It is most interesting that the author's critic should, by his own work, have brought the values of the author which are cited above completely into line with those of other recent workers. Using 35·473 instead of 35·457 for the atomic weight of chlorine as above, the author's values for the atomic weight of nitrogen become 14·013 from the chloride and 14·010 from the bromide. When it is remembered that only one gravimetric and two volumetric determinations were made with the chloride, closer agreement could not be expected, and the value 14·010 deduced from the large number of experiments made with the bromide seems completely established.

With regard to the suggestion that the low value found by the author for the bromide was due to his hydrobromic acid containing chlorine, the results given in his paper on the preparation of pure hydrobromic acid (*Trans.*, 1900, **77**, 651) are a sufficient answer. The bromine used was purified by the method given by Stas, by solution in potassium bromide with the addition of zinc oxide. It ought to have been stated that the silver used in experiment VI (*b*) (*Trans.*, 1901, **79**, 152) was cleaned by acid, as recommended by Richards, after fusion on lime and before it was heated in hydrogen.

232. "The solubility of zinc hydroxide in alkalis."
By James Moir.

When the precipitate of zinc hydroxide dissolves in excess of caustic alkali, the phenomenon is essentially an equilibrium between the alkali and zincic acid, and this equilibrium may be reached from both sides: (1) addition of excess of zinc hydroxide to caustic alkali, and (2) dilution with water of a strong solution previously saturated with zinc hydroxide. In the latter case, some of the hydroxide is reprecipitated and an equilibrium is slowly reached, which, as in the first case, depends solely on the concentration of the free alkali.

Observations have been made on both lines over the range from $7N$ to $0{\cdot}01N$ alkali, below which the amount of zinc dissolved is insignificant, being little greater than that due to the solubility of zinc hydroxide in pure water. In addition, the author has succeeded in showing that the experimental results can be deduced from the ordinary assumptions of the ionic theory, so that it follows that the solubility of zinc hydroxide in alkali depends solely on the concentration of hydroxidion in the solution.

It is also shown that no definite chemical compounds (such as ZnO,8KOH) exist, since the curve obtained by plotting the results is approximately a parabola, and its tangent never passes through the origin.

A practical result of the investigation is to show that in working cyanide solutions scarcely any of the zinc is present as zincate, but nearly all is zincocyanide.

The formula, giving the dissolved zinc in terms of the concentration of alkali, is $y = 0{\cdot}004x\left(\frac{79x+6}{x+2}\right)$, where y and x are expressed in gram-molecules.

The following list gives a comparison of calculated values of y with those obtained by interpolation from the experimental curves:

(1)	7·5*N*	NaOH, $x = 7·5$,	y calculated	= 1·89,	y observed	= 1·692
(2)	5·5*N*	KOH, $x = 5·5$	„	1·291,	„	1·36
(3)	2·5*N*	NaOH, $x = 2·5$	„	0·452,	„	0·48
(4)	2·0*N*	KOH, $x = 2·0$	„	0·328,	„	0·32
(5)	1·5*N*	KOH, $x = 1·5$	„	0·2033,	„	0·21
(6)	1·3*N*	NaOH, $x = 1·3$	„	0·171,	„	0·17
(7)	1*N*	KOH, $x = 1$	„	0·1132,	„	0·110
(8)	0·5*N*	NaOH, $x = 0·5$	„	0·0364,	„	0·040
(9)	0·1*N*	NaOH, $x = 0·1$	„	0·00265,	„	0·0035
(10)	0·05*N*	NaOH, $x = 0·05$	„	0·00097,	„	0·0010
(11)	0·01*N*	NaOH, $x = 0·01$	„	0·000135,	„	0·0002

The theoretical results are usually a little too low, which points to a small error in the value of the constants assumed; but on the whole the agreement between theory and practice is as good as could be expected considering that the experiments were not made at absolutely constant temperature. This agreement cannot be fortuitous, and vindicates the correctness of the assumptions made at the beginning regarding the constitution of zincate solutions and the applicability of the ionic theory. They show also that the whole phenomenon is not one of the formation of definite chemical compounds, but is purely conditioned by the strength of the alkali.

Some of the experimental results are abnormal, especially those obtained by diluting a strong saturated zincate solution. This effect is due to the persistence of the state of supersaturation. The reactions $K_2ZnO_2 + H_2O \longrightarrow KHZnO_2 + KOH \longrightarrow H_2ZnO_2 + 2KOH$ have evidently slow velocities, nevertheless the hydrolysis is eventually very complete, and, ultimately, the same result is obtained as if alkali of the final concentration had been treated with excess of zinc hydroxide. Zinc hydroxide, acting as zincic acid, has therefore a different constant of dissociation from its ordinary basic one, and, in fact, the constant of the equation $(H^{\cdot})(HZnO_2') = K.(H_2ZnO_2)$ is rather less than that of water, a fact which accounts for the extensive hydrolysis of the salts of zincic acid.

233. "The slow combustion of carbon disulphide." By Norman Smith.

Experiments have been carried out in order to determine the composition of the reddish-brown deposit formed when carbon disulphide and oxygen are passed through a heated tube (compare Turpin, *Brit. Assoc. Reports*, 1890, 776; Dixon and Russell, *Trans.*, 1899, **75**, 603). The deposit consists chiefly of an acidic compound $C_{16}H_6O_4S_8$. Another acidic substance or substances containing less carbon and more sulphur

than the foregoing product, and very small quantities of free carbon and sulphur, are also found to be present. The silver and ammonium salts of the compound $C_{16}H_6O_4S_8$ have been prepared. The gaseous products consist chiefly of sulphur dioxide with small amounts of carbon dioxide.

At the next Ordinary Meeting, on **Thursday**, January **18th**, 1906, at **8.30** p.m., the following papers will be communicated :

"The refractive indices of crystallising solutions with especial reference to the passage from the meta-stable to the labile condition." By H. A. Miers and F. Isaac.

"The determination of available plant food in soils by the use of weak acid solvents. Part II." By A. D. Hall and A. Amos.

"The action of ammonia and amines on diazobenzene picrate." By O. Silberrad and G. Rotter.

"The preparation of *p*-bistriazobenzene." By O. Silberrad and B. J. Smart.

"Gradual decomposition of ethyl diazoacetate." By O. Silberrad and C. S. Roy.

"Studies on nitrogen iodide. Part III. The action of methyl and benzyl iodides." By O. Silberrad and B. J. Smart.

"Silicon researches. Part X. Silicon thiocyanate." By J. E. Reynolds.

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